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THE CANYONS OF NORTHEASTERN NEW MEXICO*

BY WILLIS T. LEE,
Of the Johns Hopkins University, Baltimore, Md.

OUTLINE

1. *General view of the region.*
   a. Benches, mesas and plains.
2. *Geological formations.*
3. *The Rio Cimarron Canyon.*
   a. General description.
   b. Mesa-buttes—"island mesas" and "head-land mesas"—how formed.
4. *The Canadian Canyon.*
   a. General description. Structure of the region drained.
   b. The Canadian Canyon—a young canyon.
   The Canadian Valley—an old canyon.
5. *History of the Canyons.*
   a. Data.
      (1) Canyons are cut in the flanks of a broad uplift.
      (2) Rio Cimarron Canyon comparatively old.
      (3) Original thickness of sediments.
      (4) Present maximum and average thicknesses.
      (5) Ancient river gravels. An obsolete river. Its relation to present river courses.
      (6) Relation of the upper Canadian to the Rio Cimarron and to the Canadian Valley.
      (7) Relations of the rivers to volcanic disturbance.

*Companion paper to that on "Canyons of Southeastern Colorado," The JOURNAL OF GEOGRAPHY, Vol I., pages 357-371.

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b. Inferences.

(1) Extent of degradation by the ancient rivers. Original extent of the older lava flows.

(2) Inauguration of canyon cutting. Relation of the new Rio Cimarron to the old.

(3) Deflection of the upper part of the Rio Cimarron.

6. *Amount of degradation.*

THE Canyons of Northeastern New Mexico are cut in the eastern and southern slopes of the broad uplift whose axis extends eastward from the mountains approximately along the Colorado-New Mexico boundary line. Along the crest of this uplift extends a series of lava-capped mesas, which rise to a maximum elevation of 9,586 feet (Fishers Peak), or about 3,500 feet above the general level of the plains. The mesa tops represent a former continuous surface, which has since been deeply dissected, leaving the mesas separated by short, rugged canyons. It is among these high mesas that the Rio Cimarron rises. While the Canadian River also drains a part of the mesa region, its waters are derived principally from the eastern slopes of the mountains. The tributaries of these rivers have all cut more or less extensive canyons. In the region shown, then, in the accompanying sketch map (Figure 1), the canyons occur in two systems, the Rio Cimarron and the Canadian.

The region here considered embraces the northwest corner of the area described by Mr. R. T. Hill as the Texas region, and the larger physical features have been described in his work.* He says of the general topography of the region: "The plateau plain of Northern New Mexico . . . resolves itself into three great topographic benches or levels standing one above another, which may be designated in descending series, the *Mesa de Maya*, the *Ocate* and the *Las Vegas* plain."

The upper bench, or Mesa de Maya, extends from Raton eastward at least to the junction of Carrizo Creek and the Rio Cimarron, a distance of 85 miles. Beyond this I cannot speak from personal observation. The maximum width of the mesa, north and south, including the outliers, is something over 40 miles. Fowlers Mesa and Mount Carrizo† are outliers to the north of Mesa de Maya proper and various small lava-capped mesas south of Folsom, N. M., are isolated remnants to the south. This high plateau has been deeply dissected into more or less distinct mesas,

*U. S. Geological Survey, *Topographic Atlas*, "Physical Geography of the Texas Region."

†U. S. Geological Survey, Mt. Carrizo Sheet.

which fall naturally into two groups separated by Emery Gap. This gap is also known as Cimarron Pass, where the old Santa Fe trail passed the divide, and where the Colorado and Southern Railroad now passes it. The principal mesas of the western group are locally known as Chicorico

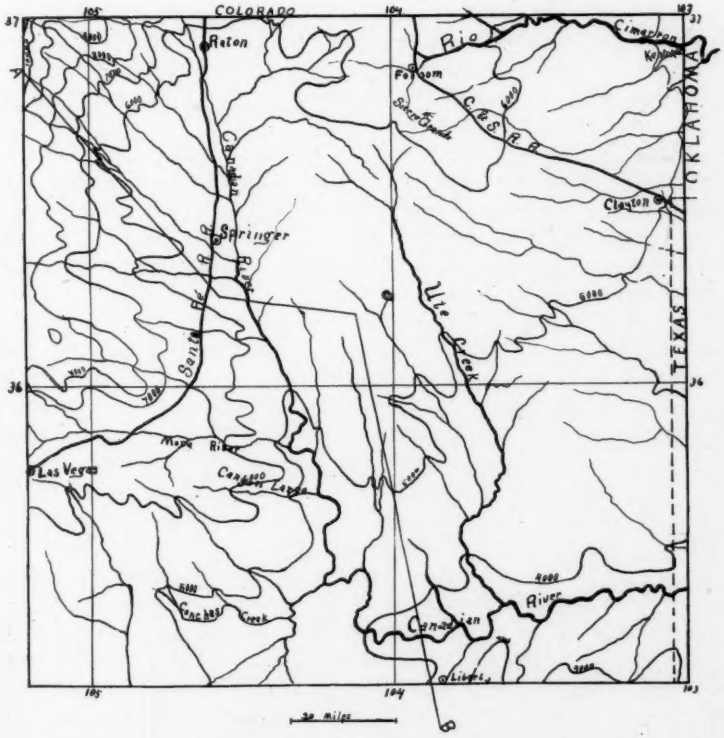


FIG. 1. *Sketch Map of Northeastern New Mexico.*

Mesa, 15 miles long, with a maximum width of about 10 miles‡; Bartlett Mesa, 6 by 10 miles, and Johnson Mesa, 15 by 25 miles. These mesas are separated by narrow passes and rugged precipitous valleys.

The eastern group consists of one large mesa—the Mesa de Maya proper—and several small isolated ones. The elevation of the eastern group is not so great as that of the western group, and is therefore not

‡See Sectional Map of Colfax and Mora Counties, N. M.

so extensively dissected. The canyons trenching the sides are narrower and not so deep as those further to the west.

The elevated bench, then, which Mr. Hill calls the Mesa de Maya, is a deeply dissected table land, the original surface of which has been preserved in the tops of the basalt covered mesas. Mesa de Maya is the name given to the principal mesa of the eastern group, and has been borrowed to designate the whole group. The name is peculiarly appropriate, since it means to the Mexicans, who gave it, "the table of mail." The hard basalt caps, terminated by their columnar palisades, give in truth the appearance of armored mesas.

From Fishers Peak (9,586 feet), the highest point of this plateau, the surface slopes eastward and southward. Its elevation near the mouth of Carrizo Creek, Oklahoma, is 4,800 feet. The eastward slope, therefore, lowers the surface 4,786 feet within a distance of 86 miles—an average descent of about 55 feet to the mile. The northern edge of the mesa forms the divide between the waters of the Purgatory to the north and those of the Rio Cimarron and Canadian to the south. The mesa surface slopes more rapidly than the surfaces of the lower benches—the Ocate and the Las Vegas plains. In the vicinity of Folsom the mesa surface, represented now by isolated remnants, merges into the Las Vegas plains. (See Figure 2.) The same relation also obtains eastward from Folsom, where the mesa lavas rest upon the Dakota sandstone.

The Ocate bench is a comparatively elevated region, lying along the eastern front of the mountains. It is deeply dissected and is terminated on the east by a prominent escarpment. The cliffs of this escarpment are formed by a hard sandstone layer—probably the Fox Hills. Above this sandstone rests the Laramie formation, rich in coal, and beneath it lie the Pierre shales. This bench is the southward continuation of the one described in a former paper, "The Canyons of Southeastern Colorado"* and extends, according to Mr. Hill, from the Spanish Peaks, Colo., southward to Las Vegas, N. M. The divide at the top of this bench between the drainage of the Purgatory and that of the Canadian is locally known as the Raton Mountains.

The Las Vegas plains occupy the principal part of the area here considered. They may be described in general terms as forming a broad stratum plain controlled by the Dakota sandstone. Over a great part of the area the Dakota is covered only by a thin coating of soil. Near the mesas the overlying shales and limestones still remain, and to the south and east the surface is more or less occupied by a loose chalky

*Lee, The JOURNAL OF GEOGRAPHY, Vol. I., pages 357-371.

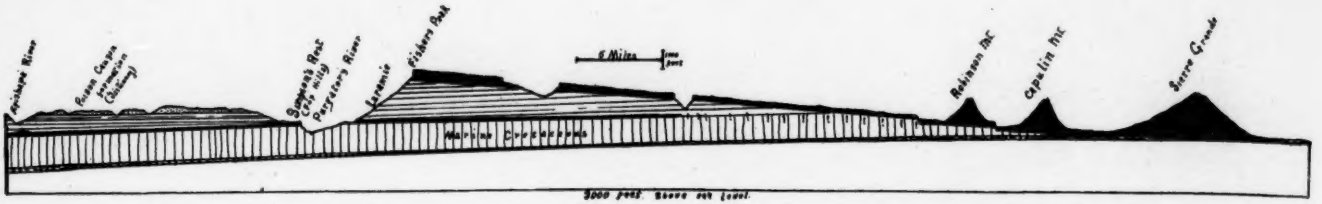


FIG. 2. *Section extending from the Apishapa River, Colorado, southeastward through Fisher's Peak to Sierre Grande, New Mexico, illustrating the Ocate bench which appears at the left, the Mesa de Maya in the center, and the Las Vegas plains at the right occupied by the volcanoes.*

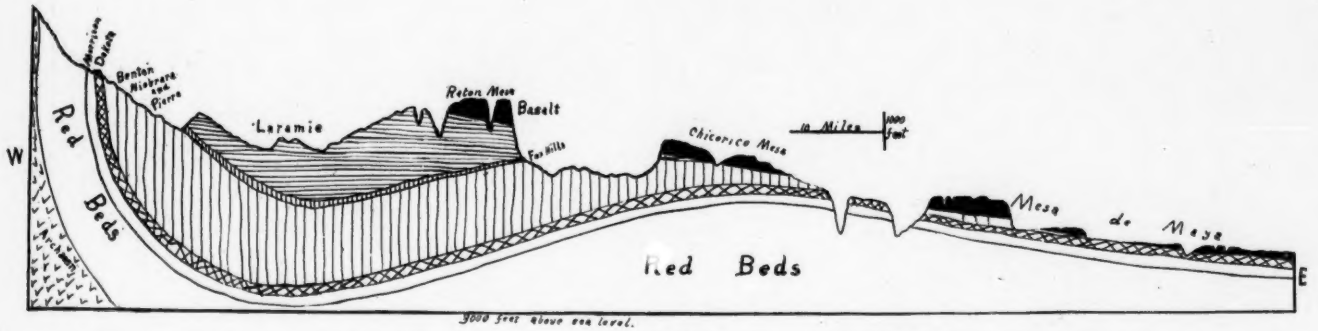


FIG. 3. *Section along the Colorado-New Mexico boundary line, from the front range of the Rocky Mountains eastward. (The relative elevations are greatly exaggerated.)*

material which answers the description of the "tepetate," described by Mr. Hill.* The Las Vegas plains are terminated on the south by the Canadian escarpment, formed by the breaking off of the Dakota sandstone. It rises to a maximum elevation of 1,500 feet above the bed of the Canadian River. It is this escarpment which Mr. Hill refers to as "one of the longest and most remarkable escarpments in America, extending a distance of nearly 300 miles."

The rock formations penetrated by the canyons are:

1st. The extrusive sheets of igneous rock, principally basalt. The relation of these sheets to the underlying formations is shown in the accompanying sections (Figures 2 and 3).

The igneous sheets are of different ages. It will answer my present purpose to refer to the mesa caps as the *older series* of flows and to those in the degraded regions among the mesas as the *younger series*. From Fishers Peak, the highest point of the mesa, and situated a few miles north of the area shown in the sketch map, eastward and southward, the older flows lie upon the edges of the sedimentary formations from Laramie to Dakota, as shown in Figure 3. The older flows were deeply eroded and large portions of them, together with the underlying formations, as far down as the Dakota sandstone, were carried away in the process of canyon cutting. At a comparatively recent date volcanic activity was renewed and sheets of lava outpourd upon the floor of the degraded areas. These recent flows are small when compared with the older ones, and yet are, in themselves, of no mean proportions. One lav stream was followed for a distance of about 27 miles. Connected with this newer series are a number of volcanic cones with craters preserved in a high state of perfection. Figure 4 is a photograph of Capulin Mountain, the best known of these recent volcanoes. Its elevation is about 9,000 feet—2,500 feet above the plain upon which it rests. It stands near Folsom, N. M., not far from the head of the Rio Cimarron Canyon.

2nd. The Laramie formation is well developed in the western part of this region and is found on the Ocate bench, previously referred to. The Laramie also extends eastward in the Mesa de Maya region under the older lava sheets for a considerable distance, but its distribution in New Mexico cannot be accurately given at present.

3rd. The marine Cretaceous formations are represented in this region. In the escarpment which borders the Ocate bench is found the

*R. T. Hill, U. S. Geological Survey, "Physical Geography of the Texas Region," p. 3; also Nueces folio No. 42.

Laramie, the Fox Hills and the Pierre formations. The Pierre is here, as elsewhere, a soft, easily eroded shale. It is this soft shale combined with the overlying hard sandstone that maintains the escarpment. In the mesa region near the northern border of the territory the shales extend eastward beyond Folsom on account of the protection afforded by the mesa lavas. But south of the mesa region the Pierre occurs for the most part west of the Canadian River.

4th. Beneath the Pierre lies a series of limestones and shales, yielding fossils of Colorado Cretaceous type. This series has a wider distribution than the Pierre, but is mostly confined to the northern and western

FIG. 4. *Mount Capulin, a Volcanic Cone near Folsom, New Mexico. The photograph is taken from the top of a neighboring volcano about five miles distant.*

borders of the Las Vegas plains. The limestones are resistant layers a few feet thick and form flat-topped benches along the canyons, a few miles back from the rim of the canyons proper. These are especially prominent along the Canadian Canyon, where they form a nearly continuous bench for a distance of about 75 miles.

5th. The Dakota sandstone is the surface formation with minor, exceptions, of the great stratum plain known as the Las Vegas plains. It is the hard layer which forms the protecting rim of the canyons and of the great Canadian escarpment.

6th. Beneath the Dakota sandstone throughout this region is a soft shale and sandstone formation which seems to be an equivalent of the Atlantosaurus Beds. My reasons for so considering them are stated in articles previously published.*

7th. The lowest formation exposed in the canyons is the Red Beds

*Lee, The Journal of Geology, Vol. IX., No. 4, May-June, 1901; also Vol. X. No. 1, January-February, 1902.

It is composed of red sandstones of varying character, interstratified with red and purple shales.

Rio Cimarron Canyon.—The Rio Cimarron rises among the high mesas north and west of Folsom, N. M. It is the middle one of the three streams of the mesa region which have cut extensive canyons—the Purgatory lying to the north and the Canadian to the south. Unlike the latter two, which drain the eastern slopes of the mountains, the Rio Cimarron rises about 60 miles east of the mountains. Although it is called a river, the amount of water is so small under ordinary circumstances that one can easily step across the stream in places. Yet this is the stream, or perhaps what is left of a much larger stream, which has cut a canyon more than 60 miles long to a maximum depth of about 1,000 feet.

The headwaters of the stream occupy short, steep-sided canyons among the mesas. But near Folsom the river plunges into a narrow gorge cut in the Dakota sandstone. Thence eastward through New Mexico and about 30 miles into Oklahoma it flows in a canyon having a maximum depth of about 1,000 feet. This maximum depth is found about 10 miles east of Folsom, where an outlier of Mesa de Maya helps to form the canyon walls. At this point the upper 300 feet of the wall is composed of formations lying above the Dakota. Beyond this point the Dakota forms the rim of the canyon, with the exception of about 20 miles of the north wall in the vicinity of Kenton, where the lava sheets of Mesa de

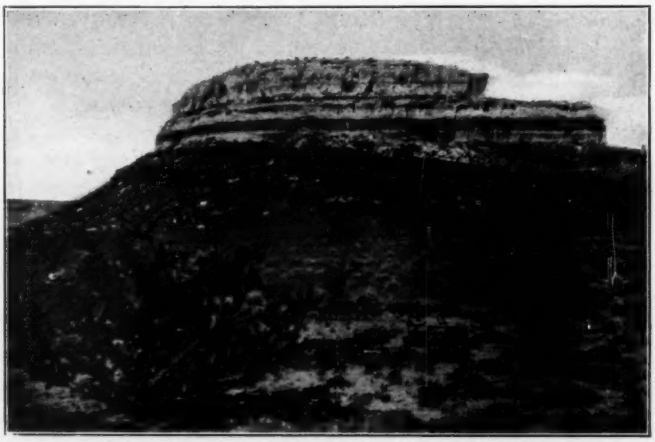


FIG. 5. *One of the Mesa-Buttes in the Canyon of the Rio Cimarron. The cliff at the top is the Exeter sandstone, which rests unconformably upon the Red Beds. At the right it is still joined by a low ridge to the canyon side.*

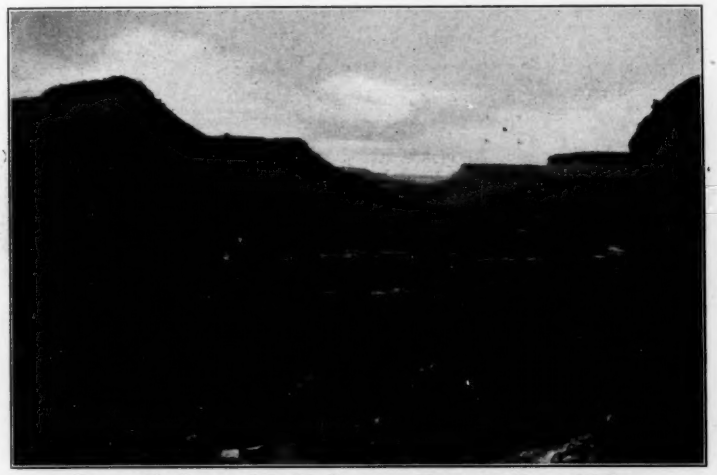


FIG. 6. *The Canyon of the Rio Cimarron, illustrating the graded floor.*

Maya appear above the Dakota and form the protecting rim. The rim rock in either case is a resistant layer and maintains the canyon walls in a precipitous state. The soft shales beneath the Dakota sandstone are easily eroded and the Red Beds are composed also of soft shales and sandstones. In the eastern half of the canyon a firm, light-colored sandstone, which I have elsewhere called the Exeter*, appears between the Red Beds proper and the Atlantosaurus shales. This sandstone is moderately resistant and appears as a light-colored band along the canyon sides, forming nearly perpendicular cliffs about 100 feet high.

The canyon widens down stream until it attains, in places, a width of several miles. The bottom is so well graded that in times of flood the water sometimes covers an area nearly a mile wide. The great regularity of the floor, in places, suggests the possibility that it may be due to a hard stratum, since the dip of the strata and the grade of the river are practically the same. But this explanation will not apply for all places, since there is one region where the Red Beds are unconformable with the overlaying formations and their upturned edges have been planed off, forming a canyon floor which does not differ materially from that where the strata lie more nearly horizontal. (See Figure 5.)

From this comparatively level floor the canyon walls rise abruptly, as shown in Figures 6 and 7. There is very little talus to be found. The

*Lee, The Journal of Geology, Vol. X., No. 1, p. 45.

FIG. 7. *Canyon of the Rio Cimarron, near the mouth of Long Canyon. The cliff at the top is of Dakota sandstone; the gentle slope beneath is occupied by the Morrison shales, and the lower slopes are Red Beds.*

sandstones of the Red Beds are not resistant enough to form talus. The Exeter sandstone, while resistant enough to form nearly perpendicular cliffs, does not form talus to any notable extent. The rim rocks—the basalt and the Dakota sandstone—keep the slopes beneath more or less strewn with debris. The basalt is usually found in small fragments, while the sandstone breaks off in huge blocks, sometimes 40 feet or more in diameter. These blocks are found from top to bottom of the canyon sides, but seldom in sufficient quantity to form accumulations. The lower slopes of the walls are more free from them than the upper slopes, while the floor of the canyon is almost entirely free from them, as if all debris had been swept from the floor up to a comparatively recent time. The canyon sides are singularly well exposed and the formations may be studied with ease.

In the wider portions of the canyon numerous mesa-buttes rise abruptly from the floor. The larger ones are still capped with the Dakota sandstone and rise to the level of the surrounding country. The smaller ones are either pointed or capped with some hard layer of a lower horizon, as in Figures 5 and 8. These mesa-buttes are somewhat numerous and vary in size from table lands many acres in extent to small pointed mounds just ready to disappear. Some of these may have been left as "cut-off spurs" by the entrenched meanders of the river, but on the

whole the gradient of the Rio Cimarron seems to be too great to admi of extensive meandering and the mesa-buttes are conceived as due mainly to the coöperation of the main stream and its tributaries, as illustrated in the diagrams, Figures 9 and 10. A part of the original surface may be left in the one case by the swinging of the entrenched main stream and a tributary, together cutting the intervening wall and leaving an *island mesa;* and in a second case the swinging of two entrenched tributaries cutting away the wall at some point between them, leaving what was formerly the projecting point, cut off as an island mesa. In either case the mesa may be partially or completely separated. The action is represented in the diagrams as having gone to the extent of diverting the tributary into the main stream back of the island mesa. This has no doubt occurred in a number of cases in the Rio Cimarron, where the mesas stand out boldly in the midst of the canyon, as in Figure 8. In other cases a more or less elevated ridge connecting the mesa with the canyon wall indicates that the neck was not entirely cut away, as in Figure 5. Such a mesa may be called a *"head-land mesa,"* as distinguished from *"island mesa."*

From Folsom to Kenton the eastward dip of the formations is much the same as the grade of the river and the depth of the canyon remains approximately the same for many miles. It gradually widens downstream to a point near Kenton, where the Dakota sandstone descends more rapidly, bringing the base near the canyon bottom. Thence eastward the river flows in a narrow gorge between walls of Dakota sand-

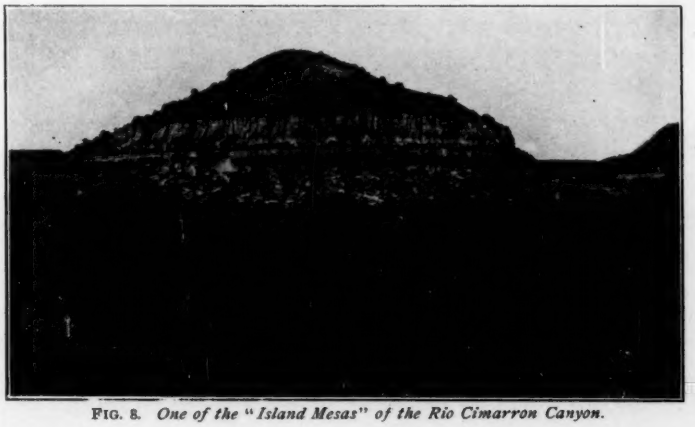
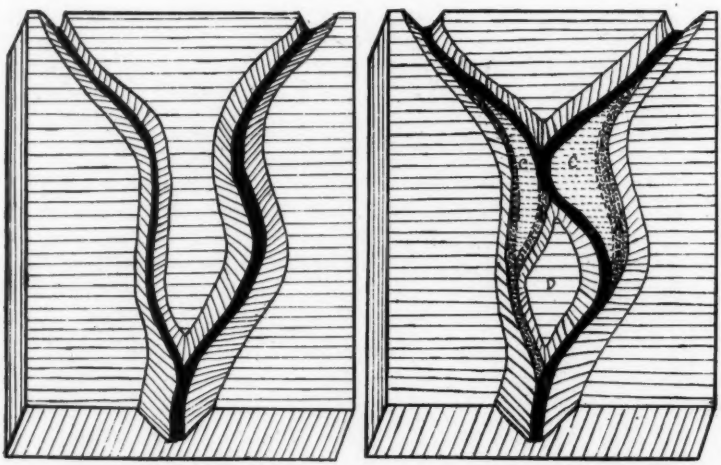


FIG. 8. *One of the "Island Mesas" of the Rio Cimarron Canyon.*

stone, until about 30 miles east of Kenton the sandstone gradually gives way and the river emerges from its gorge upon the broad open plain.

The Canadian Canyon.—The Red or Canadian River rises east of the mountains, near the northern border of New Mexico, and flows southeastward to a point near Raton. Here it turns sharply to the south and flows parallel to the mountains, 50 miles or more from them, for a distance of about 125 miles, when it turns to the east and passes through Texas, Oklahoma and Indian Territory to the Arkansas River. In its southward



FIGS. 9-10. *Diagrams illustrating the Formation of the Mesa Buttes of the Rio Cimarron canyon.* (A) *Old river channel.* (B) *Old tributary channel.* (C) *Graded floor.* (D) *Island-Mesa.*

course along the mountains it receives several tributaries of considerable size, the more important of which are the Vermejo, the Ocate, the Mora and the Cimarron (not to be confused with the Rio Cimarron just described). These enter the Canadian from the west and bring the drainage from the eastern slopes of the mountains. In addition to the above named tributaries there are several of minor importance. Many of these do not reach the mountains. They represent the plains drainage and have little or no water except in times of flood.

The structure of the region drained by the Canadian is shown in the accompanying sections, Figures 11 and 12. The mountain streams from the west flow across, or rather cut through, the Ocate bench. From thence they flow for a time upon the surface of the Las Vegas plains,

but soon cut into them, forming canyons which open into the Canadian Canyon. In the neighborhood of these larger streams the Ocate bench in deeply dissected. But in places the surface is comparatively flat, with numerous alkali encrusted hollows, which contain water only in wet weather. This character of surface is well illustrated in Van Bremmer Park and Poñil Park, lying near the source of Poñil Creek. The greater part of the bench, however, is more or less deeply trenched by the streams flowing across it. After emerging from the Ocate bench they flow for a time over the marine Cretaceous shales and limestones, where broad valleys rather than canyons are formed. But when the Dakota sandstone is reached, a canyon proper always begins. The sandstone forms the rim with more or less perpendicular cliffs, while the softer shales and sandstones beneath the Dakota form more gently sloping sides, according as the layers are soft or hard. (See Figures 13 and 14.)

The side canyons, while small in proportion to the Canadian Canyon, are yet in themselves well worthy of attention. Unfortunately, satisfactory topographic maps of this region are scarce. The one compiled by R. T. Hill (Topographic Atlas, Folio 3) gives a general view of the topography, and a comparatively small area in the vicinity of Las Vegas is covered by a series of the more detailed topographic sheets of the United States Geological Survey. The Watrous Sheet gives an excellent example of the Las Vegas plains and of the side canyons opening into the Canadian (see Figure 15, frontispiece). The surface of the plains is so nearly level that large areas exist in which there are no well defined stream courses and in which "dry lakes" abound. In my journey over this region I found stretches of 25 and 30 miles where not so much as a spring was found from which drinking water could be obtained. But wherever the streams have cut through the surface sandstone (Dakota) deep canyons are formed, such as the Conchas Canyon and Canyon Largo. At the point where the Canyon Largo joins the Canadian, the canyon is about 1,500 feet deep.

The main canyon of the Canadian begins a few miles south of Springer, where the river enters a narrow gorge in the Dakota. Thence southward for 50 miles or more the stream is confined in a narrow canyon, having a maximum depth of about 1,500 feet. In no place observed within this distance has the river widened the canyon to any considerable extent. The stream is comparatively swift and is still rapidly abrading its bed. Within a distance of 50 miles it falls approximately 1,000 feet. Soon after emerging from this young canyon in the Las Vegas plains, the river turns to the east and occupies what is termed the Canadian Valley as distinguished from the Canadian Canyon. This valley is only a very

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much widened canyon. The Canadian escarpment, previously referred to as one of the most wonderful escarpments in America, forms the northern wall of the valley, while the northern edge of the Llano Estacado, 50 to 75 miles to the south, forms the southern walls. The wall or escarpment at the west of the river, instead of extending to the south and east to form the southern wall of the valley, extends westward across the course of the Pecos River. In other words, that part of the Las Vegas plains which formerly extended southward and eastward between the Canadian and Pecos Rivers and probably joined the staked plains, has been cut away for a distance of about 50 miles, merging the two valleys virtually into one for that distance.

The valley bottom is not so well graded as are the Las Vegas plains. The rock formation is the Permian Red Beds, and instead of one especially hard layer controlling the surface, numerous moderately hard layers of sandstone occur, which cause the formation of many buttes, flat-topped mesas and stratum benches, making a rough and uneven surface. This is illustrated in the part of the Corazon sheet reproduced in Figure 15.

If we turn our attention to the history of these canyons, we must consider the Rio Cimarron and the Canadian together. If the data which I have at hand are not misleading, these rivers have not always been independent of each other. Some of the facts which must be taken into consideration in this connection are as follows:

1st. I have previously called attention to the extensive uplift in Southern Colorado and Northern New Mexico. The part which concerns the present discussion is the eastward and southward slope of the strata in the region drained by the Rio Cimarron and the Canadian Rivers. The surface formation of the northeastern part of the area covered by the accompanying sketch map—about one-fourth of the whole area—is the Dakota. The direction of slope of this formation is shown by the direction of the stream courses and by the contour lines.

2nd. I have already mentioned that the size of the Rio Cimarron Canyon is somewhat surprising when compared with the size of the stream which now occupies it. While it can scarcely be called a mature canyon, since the canyon bottom as a whole is far from grade, the broad floor and the comparative slowness with which the stream is now abrading its bed indicates that it is well on toward maturity. In some places the stream flows in a channel cut in flood plain deposit.

3rd. The Cretaceous formations probably extended at one time over the entire area discussed in this paper. The thickness of these formations, about 5,000 feet, according to Hills,* can scarcely be taken as

*R. C. Hills, U. S. Geological Survey—Elmoro Folio.

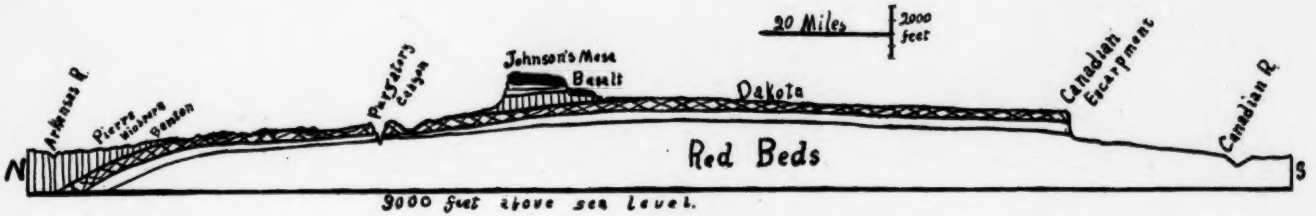

FIG. 11. *A North-South Section from the Arkansas River to the Canadian River along the 104th Meridian.*

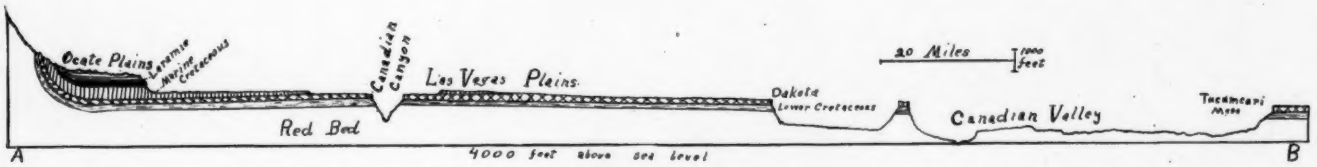

FIG. 12. *Section from the Mountains southeastward to the Staked Plains along the broken line A B of Fig. 1 (page 65), illustrative of the relation of geographic form to geographic structure.*

a measure of the original thickness further east. The Laramie and Pierre at least are variable and thin toward the east. The formations preserved by the lava caps of Mesa de Maya show a gradual thinning from top downward in an easterly and southerly direction. How much of this thinning is due to non-deposition and how much to degradation previous to the welling out of the lava cannot now be stated.

4th. In the Raton Mountains, a few miles north of the area covered by the sketch map, something near the original thickness is preserved. The maximum thickness of sediments now resting on the Dakota is about 5,000 feet. The average thickness would probably be between 3,000 and 4,000 feet.

5th. At various places underneath the lava sheets of the Mesa de Maya are found more or less extensive beds of river gravels. I have observed these beds particularly at Carrizo Springs, Colo., and in the vicinity of Folsom, N. M. At Carrizo Springs an exposure was found showing a thickness of sand, gravel and boulders, 100 feet or more in thickness. At a number of places along the sides of the mesas I have observed scattered pebbles and boulders in quantities indicating that they exist quite generally beneath the lava sheets, although not always in extensive beds. The thickness of the gravel deposits is difficult to obtain, owing to the readiness with which they crumble wherever exposed. The materials found in these gravel beds are the same as those found now in the beds of the streams which rise in the crystalline areas of the mountains. There are boulders of quartzite, gneiss, schist and various kinds of the more resistant granite rocks. These boulders were observed up to a foot or more in diameter, and all were well rounded and polished. At Carrizo Springs, Folsom and elsewhere large and permanent springs of pure cold water issue from the gravel beds. In several places where I found springs of more than ordinary size, I found also evidence of gravel beds beneath the lava.

The gravels are within the drainage area of the Rio Cimarron, but the source of that river is 60 miles east of the crystalline areas. It may be said in this connection also that the crystalline debris found in considerable quantities in the bed of the Rio Cimarron must come from these old gravel beds. There is no other obvious way for the material to reach the stream. It seems clear, therefore, that changes of considerable moment have taken place in the drainage of this region. The gravel beds seem to show that after the inauguration of the Tertiary and before the time of the lava outbursts, a strong stream rising in the mountains had established its course near the present course of the Rio Cimarron. The lava floods filled the valley, buried its gravels and

covered the surrounding country. When the drainage was reëstablished it seems to have been, in general, along the old lines, for parts of the lava-covered surface are found, both north and south of the present Rio Cimarron Canyon.

Another fact worthy of note in this connection is that the Rio Cimarron drops almost immediately into a broad canyon whose sides are in places nearly 1,000 feet high. Had the present stream been the sole agent in cutting the canyon, it is improbable that it would have pushed the canyon back so near its source.

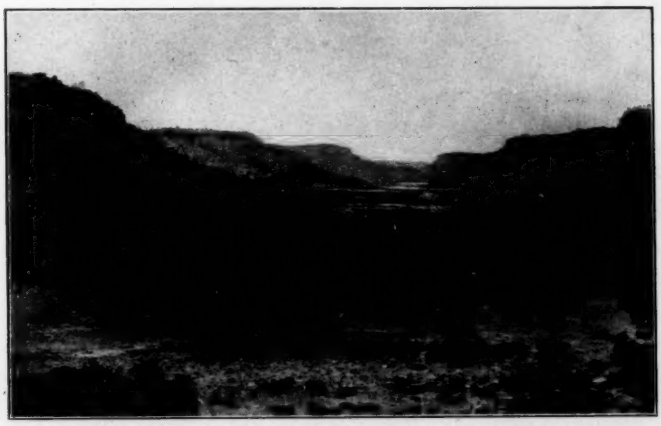

FIG. 13. *Canyon of the Canadian near Mills Ranch, showing the Dakota River in the distance and the gentler slopes of the shales and Red Beds in the middle ground.*

6th. The course of the upper Canadian for 35 miles is a little south of east. If it continued 20 miles further in this direction, it would form the headwaters of the Rio Cimarron instead of the Canadian. A few miles from Raton the river turns southward, making almost a right angle. For about 40 miles of this southward course, although it flows over the soft shales and thin limestone layers of the marine Cretaceous, it has cut but a shallow valley. A few miles south of Springer, however, it plunges into the young canyon just described. This canyon is in marked contrast with that of the Rio Cimarron and in still greater contrast with that which I have called the Canadian Valley. The volume of water in the Canadian is many times greater than that in the Rio Cimarron, and yet a canyon has been cut for only about 50 of the upper 125 miles of the river's course, while the Rio Cimarron plunges

into its canyon within about 12 miles of its source. The Canadian Canyon, then, is in its youth, while that of the Rio Cimarron is well on toward maturity. The Canadian Canyon opens abruptly into the Canadian Valley, with the escarpment or valley side passing across the canyon's course. It seems evident that the broad valley, 50 to 75 miles wide, is something more than the downstream continuation of the canyon.

7th. Between the upper Canadian and the headwaters of the Rio Cimarron lies a district of recent volcanic activity. Numerous volcanic cones and lava sheets occur there. Some of the craters indicate considerable age, while others, like Capulin (Figure 4), are but recently extinct. The relation of these volcanic outbursts to the canyon cutting is shown near Folsom. The Rio Cimarron Canyon has been cut to nearly its present dimensions through the old mesa lavas and the underlying sediments when the head of the canyon was flooded to a depth of 200 to 300 feet by a lava stream. This lava was then cut away, leaving portions of it along the canyon sides to mark its former level, and the canyon cut to its present dimensions. At a very recent time a lava stream poured down the canyon and still occupies the floor for some 15 miles or more.

The foregoing data are confessedly inadequate for the purpose of drawing definite conclusions. The region is large and much remains to be learned of it. Accurate detailed maps are wanting. I venture the following postulates, with a knowledge of the limitations, and subject to revision as future investigation shall throw light on the problems.

There seems to have been a river of considerable size flowing from the mountains eastward over the surface now represented by the lava-capped mesas of Southern Colorado and Northern New Mexico, previous to the outbursts of the mesa lavas—the older flows. This river degraded the land extensively, cutting as far down as the Dakota sandstone to the east and south. This degraded area was flooded with lava, forming a sheet which was probably continuous over something like 4,000 square miles. The lava-covered mesas extend now for a distance of 85 miles east and west and something over 40 miles north and south. There is every indication that the lava sheets originally extended for a great, though unknown, distance beyond the areas where they now occur. There are wide areas covered with lava flows south of Folsom, but it is uncertain whether they belong to the older or to the younger flows. If these should be included, the estimate of 4,000 square miles should be greatly increased—perhaps doubled.

At the time of the older lava flows, or soon thereafter, the surface

FIG. 14. *Red Beds in the Canyon of the Canadian. The floor is wholly submerged in times of flood.*

seems to have been elevated and the newly formed or reëstablished streams began the colossal work of canyon cutting and mesa forming, which appears in this region. The Rio Cimarron at this time probably extended westward to the mountains and was a much larger stream than it is at the present time. At a much later date, when the Rio Cimarron Canyon was practically complete and the general surface degraded to something near its present condition, came the later and more restricted volcanic disturbances in the vicinity of Folsom. The disturbed district is directly in the path of the postulated old Rio Cimarron. It is probable that these later volcanic disturbances, and possible crust movements accompanying them, cut off the headwaters of the Rio Cimarron and deflected them to the south. There may also have been a tilting of the surface to the south at the same time, which gives the southward trend to all of the tributaries of the Canadian as far south as Conchas Creek. Whether from tilting or from some other cause, it is probable that at a comparatively recent date the headwaters of the Rio Cimarron were turned southward into the Canadian River and the cutting of the Canadian Canyon begun.

The quantity of material removed from this region, as indicated by the mesas and canyons, is well worth attention. The amount of work done may not be especially remarkable when compared with that of other rivers, but the present topography is such as to present the amount of

degradation to the mind of the observer in a somewhat remarkable way. Take, for example, the journey from the Canadian Valley northward to the mesa region. From the valley, 50 to 75 miles wide, one ascends the escarpment, 1,000 to 1,500 feet, to the Las Vegas plains. Fifty to eighty miles to the northward stands the escarpment of the Ocate bench, and still further north appear the great lava-capped mesas. Between the level represented by Fishers Peak and that of the Canadian River, where it emerges from the escarpment into the Canadian Valley, a thickness of about 5,000 feet of rock has been removed. From Fishers Peak to the general level of the plains a depth of about 3,500 feet is obtained within a horizontal distance of a few miles. At the mouth of the Canadian Canyon the walls are about 1,500 feet high. These two figures alone make up the 5,000 feet, irrespective of some depth represented by the gentler slopes of the plains.

While something near the original thickness of the formations is preserved in the western part of the region, there is nothing in the eastern part to indicate the amount of surface degradation. As I have already pointed out, the rivers of early Tertiary time degraded the region to a great though unknown extent. The actual amount of degradation, therefore, for the entire region cannot be estimated in any satisfactory manner. Not so, however, with the broad valley of the Canadian. While it represents but a small part of the total amount of erosion of the region, a rough estimate may be of use in gaining come conception of the amount of work done over the entire region. An inspection of such topographic maps as are available indicates that more than 5,000 square miles are included in the Canadian Valley within the territory of New Mexico and between the bounding escarpments. The depth of the valley below the surface of the high plains in which it is carved is 600 to 1,000 feet at the eastern limit and something over 1,500 feet at the western limit of the region. Along the line of the accompanying section (Figure 12), the river bed is about 2,000 feet below the rim of the escarpment to the north. The roughness of the valley floor makes anything but a rough approximation of the average depth impracticable at present. But it is certainly conservative to estimate that an area of 5,000 square miles has been degraded to an average depth of 1,000 feet. Accepting this estimate, about 947 cubic miles of material have been carried away in the excavation of the Canadian Valley alone. But this amount, great as it is, seems small when one tries to realize the amount of material which must have been carried away in the process of carrying out the Las Vegas plains and lava-capped mesas.

THE COURSE OF STUDY IN GEOGRAPHY AND NATURE STUDY AT THE SPEYER SCHOOL, TEACHERS COLLEGE, COLUMBIA UNIVERSITY*

THE Speyer School of Teachers College, Columbia University, was established a few years ago to serve as a school of practice, observation and experimentation for the students in education at Teachers College. The school is a free school and draws its pupils largely from the homes of mechanics and laboring men. There is a special need, therefore, that the curriculum of the school be practical and personal, as well as academic in tone. The curriculum, so far as published, is tentative only, but is full of suggestions to those teachers in similar localities, or indeed, anywhere, who feel the need of making their work living and helpful in more ways than as mental discipline. The work in Geography and Nature Study is reproduced here because it is believed that there are many teachers who will gain light and inspiration therefrom. The material presented here is primarily to be credited to Frank M. McMurry, Professor of Elementary Teaching in the Teachers College and Supervisor in the Speyer School.—*Editor.*

FIRST GRADE

(Basis of year's work is largely Study and Reproduction of Surrounding Occupations.)

Occupations

The home and its immediate surroundings.

Plan of house (or flat); number of rooms; arrangement and use of each. (Floor plan represented by blocks and drawings.)

Furniture and decorations—study best arrangement. (Compare with school building.)

Street.

What the city authorities do to keep it clean.

What children can do to make it attractive.

*Abstracted and reprinted by permission from full account of curriculum given in *The Teachers College Record*, Vol. IV., No. 1, January, 1903.

Real and imaginary buildings.

Floor plans of same represented by blocks.
Measure dimensions of school building, etc., and represent by blocks, to a scale roughly.
Drawings.
Furniture and decoration—by blocks, etc.
Verbal descriptions.

Vegetable and fruit garden—Fall work.

Garden represented in sand; by blocks; by drawings.
Naming of products still found there.
Preparation of these products for market.
Marketing of same in play.
Study of garden implements.
Effect of frost on soil.
Gardener's preparation for winter.

Vegetable and fruit garden—Spring work.

Preparation of soil. School garden on roof.
Making of beds; planting seeds and setting out plants.
Kinds of products. First kinds marketed. Preparation for market.
Play marketing.
Study of garden implements.

Neighboring grocery store.

Represented by blocks—floor plan (to a scale) and walls; counters; refrigerator; cash stand.
Articles seen there on excursion recalled.
Stocking store and placing stock.
Buying and selling in play—children giving orders, as parents do.
Actual use of measures; i. e., pint, quart, pound (bags weighing one, two, three, five pounds used).
Give approximate dimensions of objects as part of description.
Tying knots.
Wrapping bundles.
Judging quality of apples, potatoes, oranges, cabbages, bananas, beets, etc., by appearance, size and by touch.

Ice Industry.

When and how ice is gotten. How preserved.
Story of a block of ice.
Representation of ice house, with ice in it.
Judging quality of ice.

How to make most use of in summer.
Represent layer of ice over water by means of cork.

Bakery.

Representation of store, counters, etc., by blocks.
Represent oven and other objects in basement.
Names of utensils and materials used.
Grains of wheat examined—milling process roughly reproduced.
Play store.
Distinguish between fresh bread and stale.
Experiment with yeast and baking powder, and do some actual baking.
Actual kneading with dough (or clay), comparing with action of kneading machine seen in bakery.
Model, in clay, loaves of bread, pies, cakes, doughnuts.

Butcher shop.

A few facts only as:
The kind of animal that produces beef; mutton; veal; ham and bacon.
Meat does not keep indefinitely; keeps best in clean, cold place.
Meat flecked with pieces of fat is likely to be good, etc.

Dairy store.

Description of same.
Delivery of milk about city.
Where milk comes from.
Plan of dairy-barn, in blocks. (Excursion.)
Feed of cows, in summer and in winter.
Visit to feed store.
Care of milk.
Transportation.
Making of butter; judging good butter.
Recognition of cream and skimmed milk.
Skimming.
Buttermilk.
Cheese.

Nature Study

Fall.

Names of vegetables and fresh fruits at store; some description; use of each; manner of eating. Vegetables in garden; names; plan of reproduction; seeds. Potato. Names and description of

favorite flowers. Collection of leaves; naming trees from which they come. Differences between trees and animals in growth, and comparison with human growth. Flight of birds to warmer countries. Excursions, if possible, to zoölogical garden; discussion of care of animals, involving comparison with ourselves as to heat necessary (thermometer), covering, foods, change from summer to winter, etc.

Winter.

Home pets—squirrel, cat and dog. Rat and mouse.
Cow—uses of milk, hide, meat, hair.
Care of house plants—care and study of those in school.
Collection of nuts, with names.
Wheat—with pictures of fields of wheat—threshing.
Pine tree.
Snow and ice. Other forms of water—dew, frost, rain, fog, hail.

Spring.

Vegetables and fruits in grocery—order of arrival at store; description; manner of raising; of eating.
Preparation of garden in window—out of doors, possibly. Planting and caring for beans, sweet peas and wheat. Observations of their growth. A few vegetables.
Visits to florists.
Favorite flowers studied.
Naming of common trees—with some description.
Study and care of plants in school and home.
Return of the birds.
Common birds—sparrow, robin, crow.
Barnyard fowl—hens, ducks, chickens, ducklings.

SECOND GRADE

(*Basis of year's work is Surrounding Occupations, and the Eskimos as Representatives of one phase of Primitive Life.*)

Occupations and Primitive Life

Vegetable and fruit garden.

Fall.—Names of products. Preparation for market. Description of work, in first person.
Spring.—Preparation of soil; arrangements of beds; planting of seeds; hot-beds; setting out of plants, etc. Representative vegetables traced from time of planting to time of marketing.

Typical farm.

House, barn and other buildings represented in sand and by blocks. Well. Division into fields; products, fences (boards, rails, wire). Farm life during spring, summer, autumn, winter. Comparison with life in city. Animals on farm and care of same (horses, cows, chickens).

Dairy farm reproduced in sand and blocks. Life described.

Sheep ranch, with corrals. Life of ranchman.

Typical village.

Reproduced in sand, blocks (clay), with outlying farms indicated.

Principal buildings (post-office, grocery, blacksmith shop, railroad station).

Village house compared with typical house in city, play-grounds, etc.

Streets in comparison with those of city.

Relation of village to surrounding farms—to city. Advantages of telephone, telegraph.

Eskimos.

Their direction from us.

Appearance of their country. Seasons. Houses—furniture, utensils. Build house of clay.

Dress.

Food. Manner of catching animals.

Weapons.

Modes of travel—sledge, boats, dogs, harness.

Other customs.

The Home.

Ventilation. Method of securing it.

Light; eyes, health, happiness. Sink and dark corners. Best location for apartments.

Sweeping. How to hold broom so as to avoid dust. Use of tea leaves or wet paper. Dark corners, etc. Dusting. Best material for dusters. (Read portion of Autobiography of Booker T. Washington.)

Furniture. Arrangement of same.

Table. Setting same.

Heat. Purpose of thermometer. Proper place to hang it. Reading of it. Effects of too much or too little heat.

These ideas applied, so far as possible, to school-room, committees on care of room being appointed from time to time.

Old frame building.

Examined and reproduced crudely, with sticks, boards and blocks. Visit both frame, brick and stone buildings under construction. Kinds of material used.

Division of labor.

Lumbering. (Excursion to lumber yard.) Description of forest; camp life. Representation of lumber camp. Transportation. Saw mill. Story of a board (very simple outline of facts).

Brick making. Briefly described and reproduced. Uses of brick.

Quarrying. Blasting in city. Uses of stone. Visit to piers where stone is imported.

Mortar. Making of same. Uses.

NATURE STUDY

Review and further study of vegetables found in garden and in grocery Small hot-bed in box in school-room, also early plants raised. Return of life in spring. Germination of pea, bean and, possibly, corn.

Proper care of house plants; actual care of those in school. Protection against insects. Care of house pets.

Manner of raising common fruits—apples, peaches, plums, etc.

Preparation of plants for winter; of man for winter. House, clothing. Some study of heating apparatus and of coal. Experiments with coal, uses. Records of weight and height of children. Of animals also. Uses of animals' coverings to man, as skins, wool, furs. Changes of clothing as warm weather approaches.

Pine tree reviewed. Elm tree.

Rabbit (compare with squirrel; rat and mouse reviewed). Further study of cow. Goat and sheep.

Hens and chickens; eiderduck; reindeer; seal; walrus; polar bear. Silkworm and cocoon.

Some effects of heat and cold. Forms of water, etc.

Metamorphosis of cabbage-caterpillar.

THIRD GRADE

(*Primitive Life the leading line of work.*)

PRIMITIVE LIFE

Story of Ab (cave dwellers, etc.)

Thompson Indians in Canada at present time. (Specially chosen because their habits of life are extensively shown in American Museum of Natural History.)

Direction from here and appearance of their country.
Wigwam and winter home. Representation of same, with furniture, utensils, fuel, light. Pottery.
Food—how obtained and how prepared for eating. (Flesh, corn or other grain, beans, pumpkins.) Division of labor.
Clothing—ornaments, etc.
Traveling—roads, etc.
War—weapons; customs in war.
Musical instruments.
Picture writing.
Education—games, etc., of children.
Government. References to our government, including relations of children to one another.
Religion.

Algonquin and Iroquois Indians.
Their houses, compared with those of Thompson Indians.
Other striking points of difference.
Mandan circular house.

Cliff dwellers and Pueblo Indians.
Topics as above, in connection with Thompson Indians.
Homes represented by blocks and in clay.
Customs, etc., reproduced as far as possible.

Indians' knowledge of metals.
Their uses of them.
Our present uses of them.

Robinson Crusoe.

The Great Industries.—Largely review from new point of view. Some comparison with present methods; for example, as to food, clothing, shelter, etc.
Agriculture.
Earliest forms.
Mixed forms—migratory Indians; semi-agriculture; agriculture in true sense of highest type of Indians in North America: their customs in agriculture and products compared with our own. (Plows, domesticated animals, etc.)
Arts connected with food.
Hunting.
Fishing (examples of modern fishing apparatus, seen on Hudson River.)

Cooking and preservation of food. Contrast with present methods.
Pottery.
Basketry.
Other ancient utensils.
Modern utensils.

Dwellings.
Earliest forms.
Types, showing adaptation to climate and environment:
Eskimo hut.
Tents.
African kraal.
Log cabin.
Varieties of modern New York house.

Arts connected with clothing.
Simplest materials—grass, bark, skins, furs.
Dressing of skins.
Development of sewing.
Plaiting of grass, reeds, rushes, fibres.
Development of weaving.
Dyed cloth.
Printed cloth.—Contrast with present time.

Trade and transportation.
Earliest forms of barter.
Money.
Roads.
First forms of boats.
Canals.
First transportation by steam.
On water.
By rail.
Contrast with present time.

Preservation of knowledge.
In songs, etc., in early times.
Picture writing.
Story of the alphabet.
Printing.
Making of books. Libraries. (Visit to Columbia Library.)

Rise of æsthetic arts.

How love of beauty has been shown by all peoples.

Pictures scratched on bone, stone, etc.

Sculpture.

Painting. (Visit to The Metropolitan Museum of Art.)

NATURE STUDY

Life history—from biological point of view—of the great food and industrial plants and of animals, studied in connection with Primitive Life, or prominent in environment.

Food and industrial plants.

Cereals—fruits—vegetables. Tomato.

Fibre plants—cotton, flax, hemp. Grasses. Raffia.

Soft and hard maple. Willow. Birch tree.

Fruit trees—grafting and budding.

Study of some green-house in neighborhood. Method of raising certain house plants. Introduction of same into home. Goldenrod.

Garden work in fall and spring—out-of-doors or in window-boxes.

Some study of decay, as change, not death; contribution to life of others.

Animals.

How animals prepare for winter: horse, sparrow and robin.

Some study of birds in park, with comparison between their habits and our own.

Principal kinds of fish found in the vicinity.

Earthworm.

Wild animals of North America.

Principles of physics controlling irrigation.

Same applied to water supply in city.

Power from steam and electricity. Reference to motor power of body, the human machine.

Drainage.

Kinds of food to be avoided, with reasons.

Dangers from impure water, and ways in which it becomes contaminated.

Filtering water.

Care of drinking cups, towels—individual use of same.

Proper clothing and personal cleanliness.

Weather records.

Collection of metals.

FOURTH GRADE

GEOGRAPHY

Topography of region about the Speyer School, within a radius of from ten to twelve blocks, represented in sand.

Most important streets—highest points and main slopes.

Principal points of interest located. Directions.

Places where there is no soil—where it is shallow—where probably very deep.

Origin of this soil—its uses—fertilization.—Read *Tarr and McMurry* Series of Geographies, Volume I. of five-volume series, chapter on "Soil," page 1.

Map of above section drawn from observation of sand map (not exactly according to scale).

Distances.

Directions on the map when lying on floor, with north side toward north.

Directions on map when it is hung up.

Drawings of maps to scale.—*Tarr and McMurry*, "Maps," page 102.

Slate relief map of Manhattan Island and vicinity. Reproduction sand in Points of interest—direction from one another—distances.

Highest points and principal slopes. Hills and valleys. Origin of hills and valleys. Drainage, divides, etc., traced on relief map. —Read *Tarr and McMurry*, "Hills" and "Valleys," pages 10 and 28.

Old streams here partially traced. Work of streams.—*Tarr and McMurry*, "Rivers," page 39. Course of Hudson River traced on large map; source, Adirondacks and Catskills; other places of interest along river; harbor at mouth. Term island, peninsula, etc.—*Tarr and McMurry*, "Ponds and Lakes," page 53.

Appearance and life of typical village recalled.

Comparison of village with this section of our city, as to quantity of shipping, nature of roads, etc.

Excursion to river front near our school for observation of kinds and quantities of goods shipped there. Location on large map of places from whence many of them come.

Study of piers and buildings for storage.—*Tarr and McMurry*, "Industry and Commerce," page 81.

New York Harbor—with relief map of same.

Size; points of interest; depth of water; size of largest ships; location of piers.

Lighthouses; life-saving stations—emphasizing importance of human life and subordination of one life to others.—*Tarr and McMurry*, "The Ocean," page 62.

Why New York is a great city.—By use of globe, show favorable location of harbor, with reference to various parts of world.

Name articles of food, clothing and shelter shipped in here (to grocery, bakery, shoe shop, paint shop, factories, etc., in our vicinity) from different parts of United States. From different parts of world. Locate these places.

Likewise locate countries from which foreign inhabitants of the city have come.

Population of city. Residence section; wholesale section (meaning of wholesale); factory section.

Roads. Condition of roads before time of settlement. Kinds of roads now. How built and sources of the materials. How kept clean.

Light. Sources of light—sun; moon; artificial light. Best kind and arrangement of light when reading.

Water supply.

Government.—Read *Tarr and McMurry*, "Government," page 92.

Mayor and Departments of Police, etc.

City Hall.

Nature Study

Plants.

Collection of spices and some study of their growth. Location of countries from which they come. How the spices were formerly used; how now.

Names of common trees and leading characteristics. Type study of oak. Woods examined that are used for interior of houses and for furniture (precious woods). Collection of woods.

How common berries are raised: strawberries, raspberries, blackberries, cranberries.

Common wild flowers of this vicinity: narcissus, iris, sunflower (introduced in Greek mythology).

Animals.

Crayfish; frogs and toads.

Wild animals formerly found within a hundred miles of New York.

Wild animals of North America, such as can be seen in park or in museum (an excellent collection in The American Museum of Natural History).

Similar study in park of animals that come from foreign countries.

Atmosphere.

Amount of fresh air needed for one person. Ways in which air becomes contaminated.

Methods of ventilation; in school-building, at home, etc.

Proof that air is something.

Cause of wind.

Evaporation; rain, snow, etc.

Weather observations.—*Tarr and McMurry,* "The Air," page 71.

Experimental work with lime, cement, asphalt, etc.

FIFTH GRADE

Geography

Form and Size of the Earth; its movements; zones; form of continents and of oceans. North America and United States. Principal foreign countries. Great trade routes. Chief text, *Tarr and McMurry,* Vol. II., "The Earth as a Whole." A more intensive study of North America to begin in last part of year, with use of *Tarr and McMurry,* Vol. III., "North America," Sections I., V., VI., VII.

Nature Study

Plants.

Type study. Corn, tobacco, coffee, tea. Common weeds, as burdock, ragweed, milkweed, thistle, dandelion. Study of common flowers continued from fourth year. Cotton. Sugar cane.

Effects of frost on different kinds of plants.

Comparative study of the flora of different sections—

About New York.

In Florida.

On the prairies.

In forest region.

Animals.

Fur-bearing animals. Oyster, clam, whale, crayfish, lobster. Common birds. Animal movements. Coverings of animals and uses of same for human clothing. Effects of cold on animals, including man. Ways of taking cold; also, of avoiding colds.

Observation of heavens.

Position of sun; moon and its phases; certain stars.

Other topics.

Study of barometer. Study of heat by conduction and convection. Applications to heating and ventilating. Vital heat of the body, and methods of conserving same. Evaporation; loss of body heat through same.

SOME GLACIAL CONDITIONS AND RECENT CHANGES ON LONG ISLAND

BY EDWARD P. BUFFET,
Jersey City Heights, N. J.

IN the growth and development of Long Island are found very recent geographical events and the contemporary changes are rapid. Its coasts in many places afford opportunity to watch the processes of land formation and degradation, which are taking place so rapidly that they can be readily measured by any careful observer, and its glacial phenomena are peculiarly interesting because they are a part of the great terminal moraine of the Great Glacier. Before considering certain of the special points, let us look for a moment at the region in a general way.

While the political divisions of Long Island have always been transverse, its topographical lines of demarcation are longitudinal. On the south side is the ocean, held aloof from firm ground by a tenuous barrier of sand dunes, lined with marshes and a chain of shallow bays averaging some three miles in width. The land is flat, devoid of solid rock, either stratified or drift, and covered with forests of thick "scrub" oak and scanty pine, among which deer still run wild. From these barrens rises, far inland, a range of hills, reaching at some points an altitude of nearly 400 feet, traversing Long Island from end to end and called its "backbone." The Sound shore, lying a few miles north of

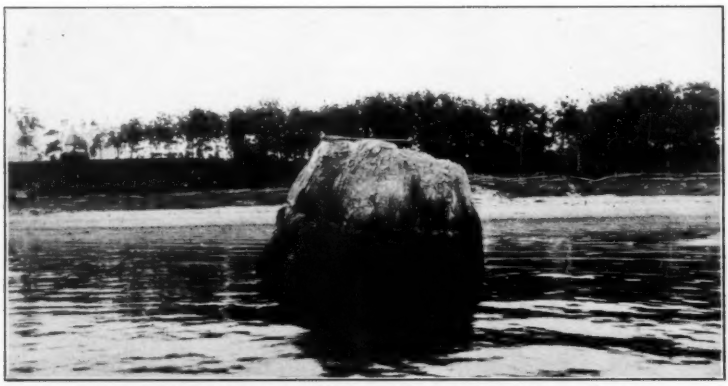

FIG. 1. *Glacial Drift Boulder near the mouth of Smithtown Harbor.*

this ridge, is furrowed with magnificent land-locked harbors, which are emphasized by promontories of bold escarpment and fringed with wooded upland. The two coasts are alike in their freedom from outcropping rock, except at the extreme western end of the island. But the country Soundward from the "backbone" differs from that Oceanward by the presence of numerous isolated boulders—some of them estimated at 1,000 to 2,000 tons in weight—which are embedded in the light soil of the upland or are laid bare by the tide on the shoals far out from the beach. Few, if any, of these boulders can have been dropped there without having been transported long distances. They are identified with the deposits of granite, gneiss, mica-slate, hornblende, conglomerate, red sandstone, etc., which lie on the mainland from the Hudson Valley to Rhode Island. The Glacier moving down across the New England upland scraped off and carried along a large part of the surface materials, regardless of size, and finally deposited a great quantity of such detritus at its southern margin, forming the backbone of Long Island. Eastwardly, this terminal moraine is continued in Block Island, Marthas Vineyard and Nantucket; westwardly, it jumps New York Bay at the Narrows, skirts along on the southern shore of Staten Island and thence proceeds across New Jersey. In its approach to the western end of Long Island it makes a curve to the northward, nearing the heads of the harbors, which here extend far inland. The second terminal moraine, which traces the outposts of a renewed invasion of ice after an interval of milder climate, lies a few miles within the line of the second, is perceptible in Cape Cod, and follows the Sound coast of

Long Island as far west as Port Jefferson, beyond which the Sound widens southwardly, forming Smithtown Bay. The swallowtail eastern forks of the island are, therefore, remnants of the respective moraines.

The specimens of glacial drift herewith illustrated were found on the coast of Smithtown Bay, about forty-five miles from New York, a district lying between the two terminal moraines, if we may assume that the second is continued under water west of Port Jefferson. The hills in this vicinity are numerous and irregular and sometimes approach 200 feet in altitude.

Figure 1 shows a magnificent boulder which lies near the mouth of Smithtown Harbor, in shallow water, a few rods off shore. Its dimensions may be judged from the eight-foot oar poised on top. The material is crystalline in structure and largely of quartz in composition. This same rock may be descried in Figure 2, in the far distance, a pier built out behind it making it look as if connected with the beach.

The boulder depicted in Figure 3 protrudes from the reflecting surface of Sunken Meadow Creek, a neighboring tidal inlet, across which the photograph was taken. The diameter of this stone is fifteen or twenty feet. By the forceful masonry of the glaciers, or of subsequent frosts, it has been cleft off flat, so that the top is a sloping table.

On the beach at the foot of a sand cliff, not far away, lies another "exotic" rock (see Figure 4), which is perhaps the most noteworthy of any, since an important part of its geological experience has taken place under contemporary observation. A generation or so ago it stood out

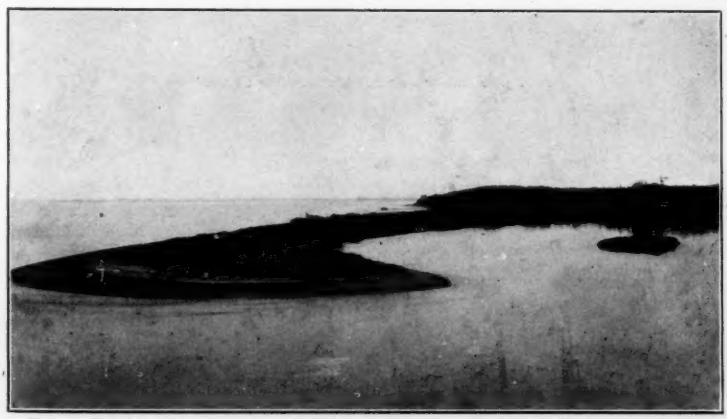

FIG. 2. *Beach at the entrance to Smithtown Harbor, from bluff on the opposite shore.*

from the face of the cliff near the summit. As the bank wore away by the weather the stone slowly moved downward. Not many years since it reached the foot, and now the terrace has receded, leaving it exposed on the shingle. The slanting line where it was embedded in the sand can readily be discerned in the picture, but the rock seems to have settled toward the horizontal since its descent. In the perspective of the picture the angle of declivity of the bluff is inadequately presented.

Such erosion of the hills is taking place all along shore. It results in a net decrease of land area, although the material washed away is

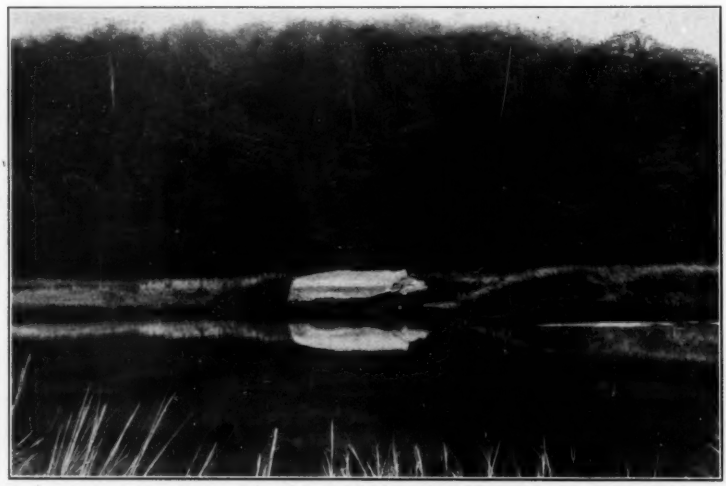

FIG. 3. *Boulder in "Sunken Meadow Creek."*

partly restored in the form of sand spits, dunes, etc. The sinuous fiords, or harbors and inlets from the Sound, are believed to have been literally ploughed out by the glaciers, since which they have been gradually silted. They are prejudiced by the degradation of the headlands, since the debris drifts over the bottom of the Sound, forming shoals and bars which render navigation precarious at half tide and often impossible at low tide. The little hill in the middle of Figure 5, clad with a grove of trees on the landward side, but worn into a bluff seaward, illustrates how the upland is disappearing before the sea. The foreground of the same photograph serves to show the extensive landslides that are occurring through the washing out and slipping of the clay which is found in that

FIG. 4. *Boulder which has slowly slid down the bluff, by weathering of the latter.*

FIG. 5. *The "Broken Lands" on Smithtown Bay, showing a Landslide in progress.*

locality. The thickly overgrown area at the foot of these cliffs, a portion of which appears at the right of the picture, is partly or wholly composed of ground which has broken from them in large masses, while a fresh example of such subsidence is seen near the middle of the view. The piece newly broken loose comprises half an acre or so in surface. The clay in this region has been utilized for brickmaking, and possibly its removal has influenced some of these landslides; but, in general, the

FIG. 6. *The new outlet of "Sunken Meadow Creek," showing the changes that are taking place.*

undermining agents seem to have been quicksands, storms, and high tides.

The famous dune beaches which have been formed by wave and wind along the ocean coast of the island have their diminutive counterparts in front of many a water inlet and reëntrant salt meadow on the Sound shore. A short, but beautiful, example of such a beach, tossed up, or carved out and maintained, by currents and gales, lies at the mouth of Smithtown Harbor. (See Figure 2.) A long barrier of similar nature guards what is, presumably, the basin of an ancient bay or lake, now occupied by "Sunken Meadow," with its creek already referred to. For a considerable distance at the lower end, the creek runs parallel with the beach, separated only by this embankment, which in time wore so

thin at one place that it seemed as if any heavy northeast gale might break through. Within a year or so the forces of nature have been assisted by a team of horses and a highway drag, with which a new channel has been opened, two or three furlongs west of the old one, enabling boats to reach the Sound by a short cut. After the dredging, this passage became clogged up. Later it reopened of its own accord, and now it forms the chief outlet of the creek. In connection with it several noteworthy phenomena are observable. Contrary to what might have been expected, the tide runs out through the new channel even more swiftly than through the old one, and it falls lower in the upper part of the creek. Naturally enough, the sandy and pebbly bottom which characterizes the stream near the beach is extending further inland, which may be due to a washing out of the overlying mud. It will be interesting to watch and see whether the new inlet causes a scouring and deepening at the head of the creek. Figure 6 shows this passage at comparatively low tide, looking eastward along the dunes toward the old gut which lies under the cliff in the distance. A sand bar, conspicuous in the right middle ground, runs abruptly across the previous main bed of the stream. This bar is not destined to remain long in its present position, for we may readily perceive that the new passage is already working to the eastward, cutting the bank away on that side and building out a point on the other. In course of time it must arrive at the former location. The old channel also traveled toward the east.

GEOGRAPHICAL NOTES

The Forty-ninth Parallel of Latitude is to be definitely marked from the Rocky Mountains to the Pacific Coast. The British Government has appointed Mr. W. F. King, chief astronomer, as commissioner, and our government has appointed Mr. Otto H. Tittmann, Superintendent of the United States Coast and Geodetic Survey, as commissioner for the United States. J. P. G.

Cotton Manufacturing.—From the census report it appears that in 1900 there were in the United States 1,051 establishments devoted to cotton manufacturing, with a capital of $467,240,157 and an annual product valued at $339,198,619. These manufactories operated

19,050,952 spindles and 455,752 looms. The leading states, arranged in the order of the number of looms, are as follows: Massachusetts, South Carolina, Rhode Island, New Hampshire, North Carolina, Maine, Connecticut, Georgia, Pennsylvania, New York.

An estimate recently made by experts as to the number and distribution of the cotton spindles of the world was as follows:

Great Britain	46,400,000 spindles.
Continent of Europe	33,000,000 "
United States, north	15,050,000 "
United States, south	5,820,000 "
Canada	640,000 "

E. D. J.

The Silk Industry in America.—The silk industry has been an attractive one in various forms for many years, and numerous efforts have been made to establish it on a firm and paying foundation. At one time it was believed that silk worm culture could be successfully carried on in this country and at very little expense by almost any one. The idea was so captivating that thousands of men, women and even children embarked in what afterwards became known as the morus multicaulis fever. This appellation was derived from the botanical name of the mulberry, on the leaves of which the silk worms feed. The venture proved a complete failure. Later attempts were made to revive this form of industry in Philadelphia, with such indifferent results that they were abandoned.

Endeavors to establish silk manufacturing industry by working up the raw product have met with better results. Indeed, the extent of the process is greater than generally supposed. According to the Census Bureau, there is now a capital of $81,082,201 invested in the business, and no less than 843 establishments are engaged in the manufacture of silk. This does not include firms that make a specialty of supplying these concerns with the necessary machinery. The importance of the industry is emphasized by the statement that 65,416 persons—34,797 women, 6,413 children and 23,206 men—are employed, and that their annual wages amount to $20,982,194. The yearly consumption of raw silk amounts to 9,760,665 pounds, costing $40,721,875. From this goods valued at $107,256,258 are made. There thus remains a balance of $45,552,189 above the cost of the raw product and the wages of the employes, a very fair result, apparently, for an infant industry.

Ten of the states are largely interested in the silk manufacturing industry, and among them Pennsylvania holds second place, having

$20,894,042 invested, and furnishing products valued at $31,072,926 a year. New Jersey, which holds first place, has $29,285,792 invested, and produces annually $39,966,662 worth of manufactured silk. The two states, it will be seen, have nearly two-thirds of all the capital invested in this industry in the country. Connecticut ranks third, with $12,166,777 invested. The somewhat surprising fact is noted that of the ten states most deeply engaged in silk manufacturing, California is the least interested, there being but $308,847 capital invested. The natural presumption would be that, being on the Pacific Coast, and so much nearer the source of supply of the raw product, her interest would be much larger. The returns of the Census Bureau concerning this industry are very gratifying, as proving the triumph of American enterprise in the face of many difficulties.—*Philadelphia Public Ledger.*

Manufacture of Paper in Formosa.—The manufacture of paper in Formosa has been an industry of considerable importance for some years. A small bamboo found in the Formosa hills is the chief material used; and, as a rule, the industry is carried on in the vicinity where this variety of bamboo is most abundant. The method of manufacture is as follows:

The young branchless bamboos are usually cut during the months of May or June, when the plant has attained a height of 4 or 5 feet. The stalks are first crushed with a wooden hammer, then placed in a cemented tank some 5 feet long, 3 feet wide and 4 feet deep. Water to cover and a quantity of lime are added, and the material is left thus to decompose for about forty-five days. It is then removed, washed with fresh water and placed in a second pit, similar in size to the above, where it is allowed to soak for a further forty-five days or more. The fibrous matter, now much softened, is placed in a stone mortar, which is used with a stone pestle worked by foot, similar to the Chinese rice-cleaning mortar. Here, the fibrous material is broken up and crushed until it has been reduced to a pulp. It is next placed on a platform and trodden by foot until the water has been partly driven out and the pulp becomes sticky. The pulp is then removed to a third cement vat, which has previously been partly filled with clean water, and is stirred until the mixture has attained the right consistency. The material is now considered ready for the final operation. For this, a screenlike implement is brought into use. This consists of a frame 2 feet 4 inches by 9 inches, supporting brass wires running crosswise and lacquered bamboo strips lengthwise, forming a fine network. A second frame of thin wood fits closely upon the screen, its outside rim being extended slightly to retain the quantity of pulp required

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for a single sheet. A third frame holds both the above together, and, by its projecting sides, furnishes a grip for the hands during its manipulation.

The complete implement is now dipped in the vat in such a way that the screen becomes covered with the pulp. The implement is lifted out horizontally and shaken a bit to distribute the pulp evenly. Most of the water passes out quickly through the netting, and, the outer frame being removed, the inner frame is placed in an inclined position to drain. When the water ceases to pass off, the screen is inverted, and the soft sheet is allowed to fall out upon a board arranged for that purpose. Thus the operation proceeds, the sheets being placed one on another until the pile is some 3 or 4 inches high. A second board is now superimposed and the lot placed under a long wooden lever near its attached end. By weights placed on the free end of the lever, the sheets are subjected to considerable pressure, which removes the superfluous water and gives compactness and firmness to them. On being released from the press, the sheets are taken out, four at a time, placed in a spilt bamboo, and hung out in the sun to dry. If the weather is unfavorable, the sheets are kept under cover until there is an opportunity to dry them. As might be expected, this extremely crude process is very wasteful of time and not infrequently, owing perhaps to unfavorable weather, six months is required before the whole operation is complete. Sizing, glazing, hot pressing and other methods of improving the grade of paper are unknown to the local Chinese, and the Formosa product is a thick, rough, coarse, straw-colored paper, abounding in partly macerated bamboo fibers, which are often so slightly incorporated with the body of the paper that they can be shaken off. The sheets measure 12 by 29 inches, and are sold for 15 sen (7.2 cents) a hundred.

The paper mulberry plant (*Broussonetia papyrifera*, Vent.) is also used in Formosa for the manufacture of paper. There is not a large local demand for this product, but it has been found very useful for paper umbrellas, lanterns, etc. Keibi (Kingboi), North Formosa, a few miles south of Taihoku, is interested in the industry, and the method of manufacture described below is that practiced there.

The bark is obtained from the hills to the east of Chureki (Tionglick) and Shinchiku (Teckcham), North Formosa, where the tree appears to be most abundant. Young trees four or five years old and those grown in shaded valleys appear to yield the best material. The bark of the whole trunk, from top to bottom, is stripped off, and its rough outer skin

is removed by scraping. It is then dried in the sun, separated into strips an inch or so wide, and packed up into small bundles. The paper maker purchases the latter at from 4 to 8 yen ($2 to $4) a picul (133⅓ pounds), according to quality, cost of transportation, etc. Eight sheets of the paper described below can be obtained from one pound of the bark. To prepare the bark for paper making, it is first soaked in cold water for twelve or thirteen hours to clean and soften it. It is then placed in a large iron pan, covered with water, to which is added some fourteen pounds of Formosa lime to every 100 pounds of bark, and boiled for twelve hours. This operation removes all gummy matters. (If lime is not used, the bark must be soaked for about a week.) The material is then vigorously washed for two hours to remove the lime, this being usually performed in the shallows of the river, a close picket bamboo fence being erected to prevent the fiber strips floating away. It is next removed to a flat stone, where it receives a strong beating for a half hour or so with two wooden mallets, the workman holding one in each hand. The long fibers readily separate under this treatment. The fibers, now thoroughly softened, are immersed in water, and then, with two knives, are chopped up into very small pieces, some half an hour being required for this operation. The small pieces are then deposited in a vat on the river bank, water is added, and the mixture is stirred for fifteen or twenty minutes, which converts it into a thin pulp, requiring no further manipulation.

While the mulberry pulp forms the fibrous material for the paper, a mucilaginous substance must be added, which is obtained from the leaves and small branches of young wikstroemia trees. In preparing the latter, the leaves and twigs are first well bruised with wooden mallets and, after water has been added, are vigorously kneaded by hand. The substance is then transferred to a basket lined with coarse jute cloth, which is fastened over the vat, the gummy liquor straining through the cloth onto the pulp.

In forming the sheet of paper, an appliance consisting of a bamboo frame some 4 feet long by 3½ feet wide, with inner cross-pieces, over which is stretched a coarse sheet of jute cloth, is used. A large number of these sievelike utensils is required, and they are taken, one at a time, to the workman at the vat. Here, the sieve is placed with one side of the frame resting on a post and the near side held by the vatman's left hand. With his right hand, the pulp is ladled out of the vat and poured onto the sieve; the latter is then given a rocking motion until the pulp is spread

over it evenly, the surplus water finding its way through the coarse cloth. When the pulp is partly thickened, the frame is removed and set up in an inclined position. If the weather is suitable, the pulp dries quickly, and on a sunny, summer day some four batches can be made, but in winter only three. When dried, the paper is stripped off the frame easily. It is of a pale mouse color, the sheets being some 3 by 3½ feet in size, and is light in weight, resembling in this respect a medium-grade tissue. It is fairly smooth and soft, but, owing to the coarse method of production, contains much half-macerated matter, small pieces of bark, etc. It sells in the local market at from 1 to 1.80 yen (50 to 90 cents) per 100 sheets. It is used in the manufacture of paper umbrellas, Chinese lanterns and rain coats.

In the manufacture of these articles, the paper is first painted with persimmon liquor, which hardens it and renders it almost impervious to water. Two or more layers glued together are generally used, and the finished product is varnished, giving a strong, water-proof article. For these purposes, the Chinese manufacturer asserts that the local paper is superior to other available papers, either domestic or foreign, not even excluding the uncommonly strong Japanese paper which, owing to its comparatively low cost, is sometimes used.

There are other materials in Formosa suitable for paper manufacture which as yet have not been utilized. The fibrous stalk of the banana plant can be obtained in abundance, and there is also considerable jute refuse which would be available. The small shrub *Wikstroemia indica* grows wild in the hills and plains and is very plentiful on the coral reefs of extreme South Formosa. A beautiful soft paper resembling French tissue has been manufactured in Tokyo from this material sent there from Formosa, and it is hoped that further experiments will be conducted to ascertain definitely the practical value of this plant for paper making.—*Consular Reports*, February, 1902.

A New Railway to Central Asia.—The Russian Government has decided to build a new and important railway line in its Central Asian dominions, from Orenburg to Tashkend. Its total length will be 1,762 versts (1,168 miles). From Orenburg the line will go south to Iletsk, past the Iletsk salt lakes, thence to Kazalinsk, on the Syr-daria, and along the valley of the Syr, past Perovsk, Julek and Turkistan, to Tashkend. The first division of this line, from Orenburg to the Mugojar hills, 270 miles, lies in a region well suited for agriculture. Then comes a stretch of land as far as Kazalinsk, which is only suited for nomad Kirghiz;

while further on the railway will enter the valley of the Syr, which has already a population of nearly 1,500,000, and, owing to its fertility, offers facilities for immigrants. It is to be remarked that the new line will compete with the Transcaspian line for the export of raw cotton from the Tashkend region.—*Geograpical Journal*, December, 1902.

Leipzig the World's Fur Market.—The City of Leipzig, Germany, is the center of the world's fur trade, according to the *New York Commercial* of October 22d. Even the market of London is only a feeder, for more than one-half of the furs brought to London are sent to the German city. The greatest quantity of furs comes from Bukhara in Turkistan, which produces almost one million of the beautiful astrakhan skins every year. These are shipped in the raw state by caravan to the Caspian Sea, and thence to Nizhniy Novgorod. Here they are dressed and finished and from here they go to Leipzig to be sold to the manufacturers of fur goods. To Leipzig come the pelts captured by Alaskan Indians and Esquimaux, Canadian half-breed trappers, Siberian hunters and Australian bushmen. The primitive hunters of China and Indo-China, who kill their small fur-bearing game with pointed bamboos, or catch it in pitfalls, work for Leipzig. Russia and Siberia send almost all the sable skins that are taken in their immense hunting grounds to Leipzig. Two million squirrel skins are shipped there each year from Russia alone. Thirty thousand foxes and one million lambs are killed annually to supply the demand of the Leipzig fur traders.

Camphor Trees in Florida.—It has been found from experimental plantings made at Winter Park, Florida, and extending over five or six years, that camphor trees will grow in the southern part of the peninsula. Considerable groves of cuttings are now being set out. In camphor producing regions of the east the camphor is obtained chiefly from the trunk and larger limbs of the tree, the wood being reduced to fineness by means of an axe or scraper. Trees less than fifty years old are not regarded as sufficiently rich in the gum to yield enough to pay for working them.

In Florida it is proposed to distill only the leaves and small branches. From various analyses that have been made of this material, it has been found that seventy-seven pounds of leaves and a greater weight of twigs are required to yield one pound of camphor. It is expected that leaves and cuttings can be taken from the tree at least twice a year.

One drawback to the Florida camphor grove proving profitable

property is the present low price of camphor gum. When the first groves were planted its price was much higher than at present. On the other hand, the camphor forests of many eastern producing districts are being destroyed by reckless cutting, and supplies from them will soon diminish. To offset this there is the possibility that camphor will soon be produced by synthetic process and the artificial camphor become a cheap commercial product, putting the native camphor industry into the same position occupied by indigo production.—*Paint, Oil and Drug Review.*

Current Articles on Commerce and Industry:

Agriculture a Scientific Pursuit, *Am. Agriculturist*, January 3.

American Ox and his Pasture (Illus.), *Rev. of Revs.*, January.

Anthracite Coal Mining, Life and Labor in, Part IV., *Eng. & Mining Journ.*, December 20.

Apples (Illus.), *Country Life in Am.*, January.

Beaumont Oil Production, *Paint, Oil and Drug Rev.*, January 14.

Beet Sugar Profits, *Comm. Bull. and N. W. Trade*, January 3.

Brazil, Trade in Northern, *Consular Rept.*, December.

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California Lemons, *Comm. Bull. and N. W. Trade*, December 27.

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Gold and Silver, World Production in 1902, *Eng. and Mining Journ.*, January 3.

Iron and Steel in 1902, *Eng. and Mining Journ.*, January 3.

Krupps and their Steel Works at Essen (Illus.), *Rev. of Revs.*, January.

Lumber on the Pacific Coast, *Miss. Valley Lumberman*, January 16.

Manufactures, American, *World's Work*, January.

Mexico, American Money in, *The Mfr.*, January 15.

Mexico, Shoe Making in, *Hide and Leather*, January 17.

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Philippine Is., Commerce of, for 1902, *Monthly Summary of Comm. of Philippine Is.*, June, 1902.

Pins and Needles, Manufacture of, *The Mfr.*, December 15.

Pomology, Progress in Am., *Am. Agriculturist*, January 3.

Publishing Industry of the U. S., *The World To-Day*, January.

Rug, The Oriental (Illus.), *The Counter*, December.

Sewing Machine Manufacture, *The Mfr.*, January 15.

Shoddy, Use of in U. S., *The Mfr.*, January 1.

Standard Oil Co., History of, Ch. III. (Illus.), *McClure's Mag.*, January.

Sugar, World's Production and Consumption, *Monthly Summary of Comm. and Finance*, November.

Transportation in New York City (map), *Harper's Weekly*, January 10.

Venezuela, *Stoves and Hardware Reporter*, December 18.

White Pine Statistics, *Miss. Valley Lumberman*, January 16.

Wool, *Textile Record*, December.

Woman that Toils, Ch. V. (Illus.), *Everybody's Mag.*, January.

EDITORIALS

THE USE OF SUPPLEMENTARY READING

IT is a recognized condition in geography teaching, in elementary schools, that no text-book can be sufficiently inclusive, and hence voluminous, to present all that a child should know in reference to the more important regions of the world. Hence supplementary reading is a necessary adjunct to a text in almost all grades. The use of supplementary reading is also valuable because it gives an opportunity for training in seeking, correlating and using scattered facts that will be very useful later, when the pupil becomes a follower of current affairs and a reader of periodical literature. It is often true that teachers consider

anything between the covers of a text-book as gospel that must not be questioned or even discussed; it must be taken on authority as incontrovertible. Supplementary reading, whether in book form or as selected scraps from current periodicals, is not usually treated so deferentially, and hence is valuable from that standpoint.

Supplementary volumes are appearing constantly and in great variety of form, style and usefulness. In some the text is spoiled by a patronizing style or by imaginary pictures that could not exist in nature. In others, material is chosen for presentation because of the name of the author, and may not be true, appropriate or usable. In others, masters of the subject with skilful pens and a style that does not show condescension, have given us very workable and much needed texts. On the whole, recent supplementary volumes are a great improvement over those that appeared a few years ago.

There is still a need, however, to incorporate in a supplementary reader, materials that show the relation of geography to history and literature. It is easier to do this with history than with literature. Descriptions in good literature are often but remotely accurate geographically, or use the environment in such a subtle way that only the advanced student of literature and geography can get value therefrom. Descriptions that have been written primarily from the geography standpoint do not often stand the tests of good literature, especially if they be in verse, and hence cannot be approved. History or literature, or any other subject in such a form that they naturally form a part of the geographical story, should be used freely. Materials that must be *dragged* in defeat their own ends, because they break the continuity of thought in the geography lesson and are not sufficiently clear cut or complete to be of any value by themselves.

Teachers have a difficult task in choosing and using supplementary materials, but it may be accepted as a motto that in no subject should supplementary material be introduced unless it strengthens the thought of the subject for which it is primarily used.

REVIEWS

Youth's Companion Series: Under Sunny Skies, pp. vi. 138; Toward the Rising Sun, pp. vi. 138; Strange Lands near Home, pp. vi. 138. 6¼x4⅝ inches. Boston, Ginn & Co., 1902.

The volumes published under the titles noted above complete the series of supplementary readers compiled from articles which have appeared from time to

time in the "Youth's Companion." They form companion volumes to the two earlier readers, "The Wide World" and "Northern Europe."

The third volume in the series, "Under Sunny Skies," affords glimpses of life in Spain, Italy, Greece, Turkey, Hungary, Syria and portions of Africa.

"Toward the Rising Sun," the fourth volume, presents pictures of life in India China, Japan, Korea, Persia and East India.

The last volume, "Strange Lands near Home," touches upon life in Mexico, the West Indies, various portions of South America and northern North America.

It is perhaps to be expected, but none the less to be regretted, that books representing many contributors should present a range of treatment from excellence to mediocrity. While many of the articles are admirable in their selection of material, in style and accuracy of portrayal, all do not come up to this standard. Even the more indifferent sketches, however, generally carry with them the conviction that the writers speak with a knowledge gained from personal experience. The interest which this inevitably arouses is sufficient to some extent to cover sins committed against style, and to render us less critical of incidents scarcely worth relating.

The illustrations are generally poor, being neither well selected nor well executed. Many of them are too small to be of value and many are indistinct.

The pronouncing vocabulary which accompanies each volume would have been of greater value had the most authoritative source for the pronunciation of geographical names been consulted.

On the whole, while the books will be found helpful to the teachers of geography, there is still room for a reader dealing principally, as do those under consideration, with the life of the various countries described, but which will hold to a high standard of excellence throughout. C. B. K.

RECENT PUBLICATIONS

Bulletins of the United States Geological Survey:*

A Gazetteer of Texas, by Henry Gannett; pp. 162; being No. 190.

Contains descriptive and statistical matter on topography, climate, forests, population, industries, railroads, etc. (with maps), and a gazetteer of places.

A Gazetteer of Cuba, by Henry Gannett; pp 113; being No. 192.

Contains statistical and descriptive matter concerning geography, mineral resources, climate, history, population and agriculture (with maps) and a gazetteer of places.

Geology and Water Resources of the Snake River Plains of Idaho, by I. C. Russell; pp. 192; being No. 199.

A well illustrated descriptive account of region considered, with maps.

The Origin of Certain Place Names in the United States; pp. 280; being No. 197; Gives origin of names of most important places in the United States.

*Sent on application to Director United States Geological Survey, Washington, D. C.

Historic Highways of America, by Archer B. Hulbert, Arthur H. Clark Company, 1902–3. Sold by subscription only.

Vol. I. *Paths of the Mound Building Indians and Great Game Animals,* pp. 140.

Considers Indian and buffalo roads as related to topography and exploration.

Vol. II. *Indian Thoroughfares,* pp. 152.

Considers especially Indian thoroughfares of Central West and relation between Indian roads, military roads and early public roads.

Vol. III. *Washington's Road,* pp. 215.

Historic account of Washington's road from Ft. Cumberland to Ft. Duquesne.

Tarr & McMurry's Geographies. Supplementary Volumes. *California,* by Harold W. Fairbanks, pp. xiv. 122, 1903.

A well illustrated descriptive account of California, with an appendix, containing more important statistics.

Teachers' Guide and Laboratory Exercises, by G. K. Gilbert and Albert P. Brigham, pp. viii. 99, D. Appleton & Co., 1903.

A suggestive guide to accompany text-book in Physical Geography, by same authors.

Descriptive Geography from Original Sources. *Asia.* By F. D. and A. J. Herbertson pp. xxxvi. 298, A. and C. Black, 1903.

Companion to volumes on Africa, North America and Central and South America. Suggestive and usable.

NEWS NOTES

THE first link in a United States cable across the Pacific has recently been completed by the connection of Honolulu and San Francisco. Messages are now regularly sent at the rate of fifty cents per word, and in the course of time the cable will be completed to the Philippines.

THE boundary between Chile and the Argentine Republic has been in dispute for a long time, and a year ago the two nations were on the verge of war. King Edward VII. has recently acted as arbitrator in the case and has rendered a decision that grants part of the disputed territory to each country.

THE region known as Acre, which a few years ago was established as an independent country, is now the cause of trouble between Brazil and Bolivia. The future control of the area will shortly be decided by the Hague Tribunal.

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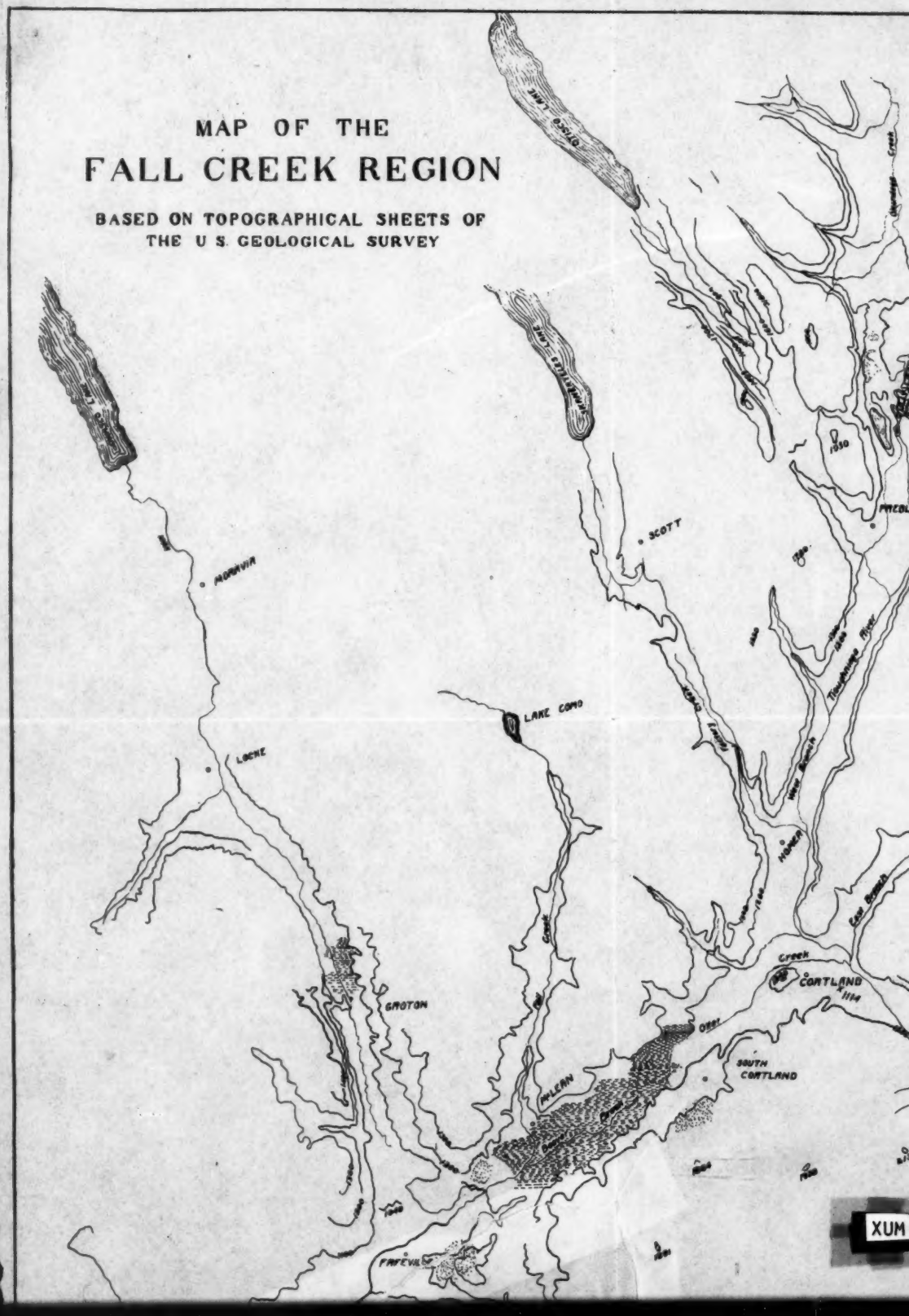
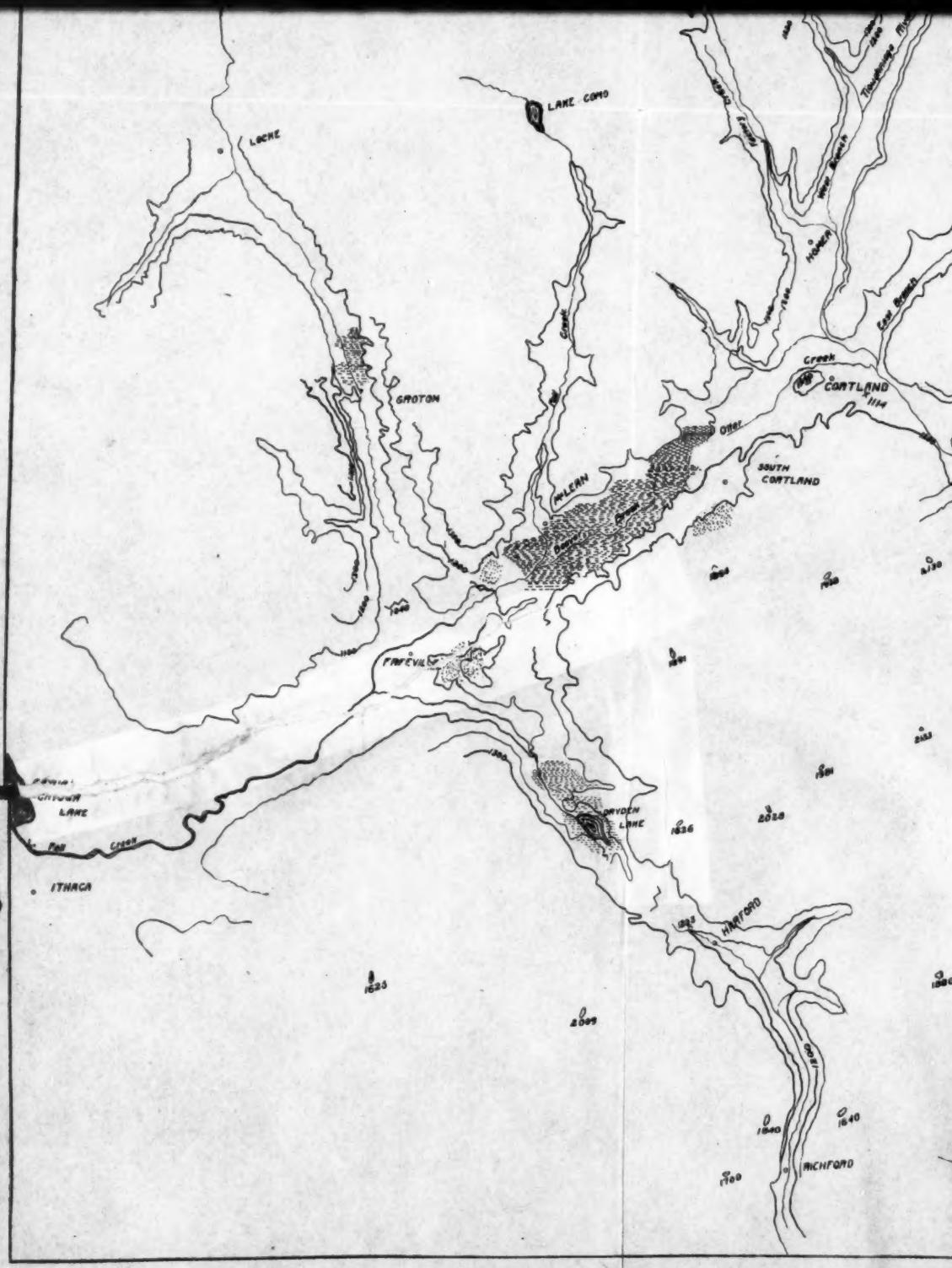
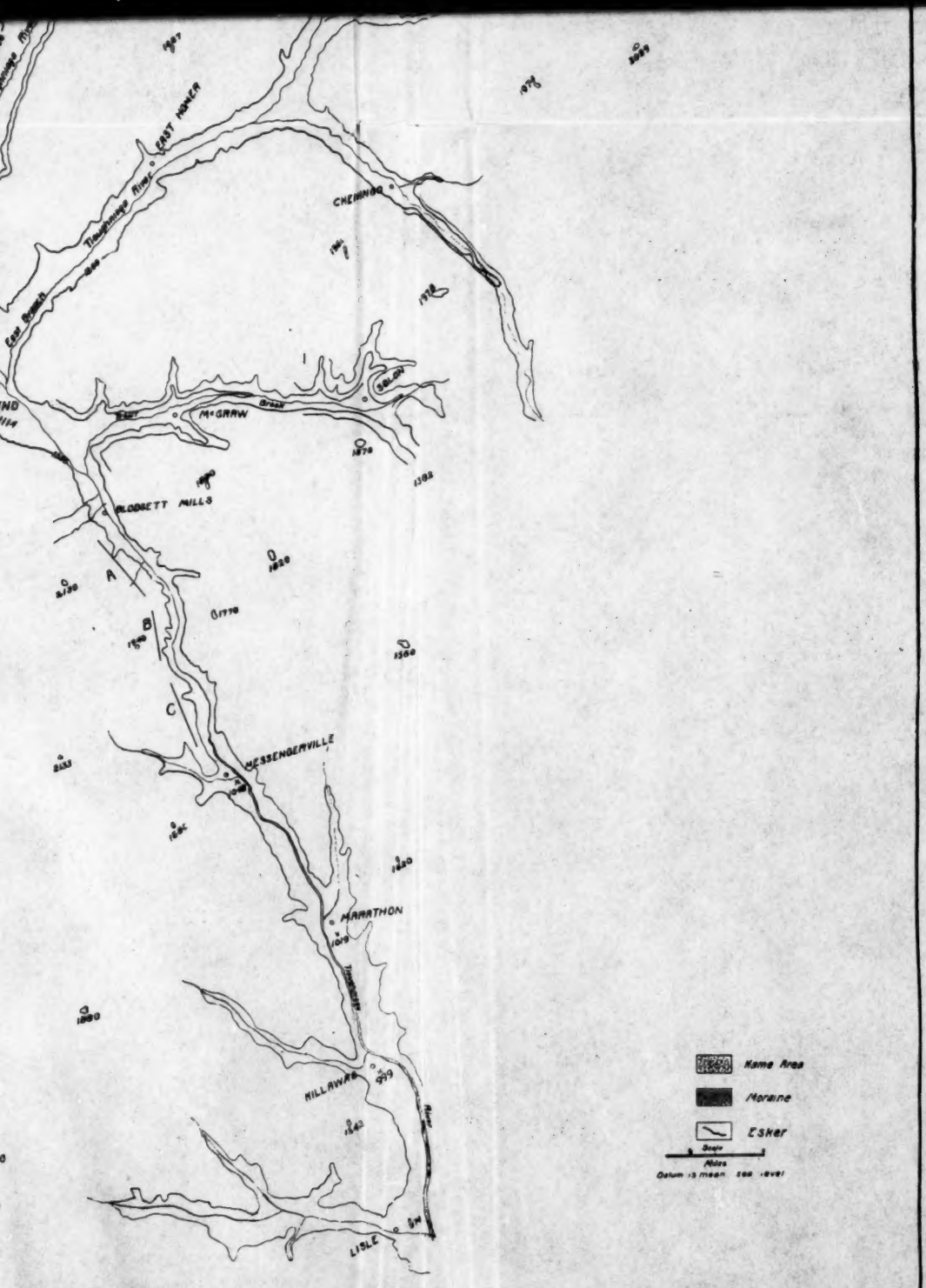

MAP OF THE
FALL CREEK REGION
BASED ON TOPOGRAPHICAL SHEETS OF
THE U S. GEOLOGICAL SURVEY
OTISCO LAKE
SKANEATELES LAKE
MORAVIA
SCOTT
LAKE CORD
LOCKE
GROTON
McLEAN
SOUTH CORTLAND
CORTLAND
FABIUS
XUM

TULLY
APLUJA
TABUS
BERNUYER
BOYLE
TRURTON
PREDLE
EAST HOWER
CHEVINGO
McGRAW
BLODGETT MILLS
A
B
C



See article, "A Type Case in Diversion of Draina



ion of Drainage," by Frank Carney, page 115.

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GEOGRAPHY *the* BASIS *of* HISTORY

GEOGRAPHY *is the basis of history, and history is nothing but the geography of times and peoples set in motion. Whoever studies one without the other understands neither, and whoever despises both should live like the mole, not on, but under, the earth. All the sciences which our century values, esteems, demands, and affords are based especially on philosophy and history; trade and politics, economy and law, medicine, and all practical knowledge and manipulation are based on geography and history. They are the stage and the book of God's household — history the book and geography the stage.* — JOHANN GOTTFRIED VON HERDER.

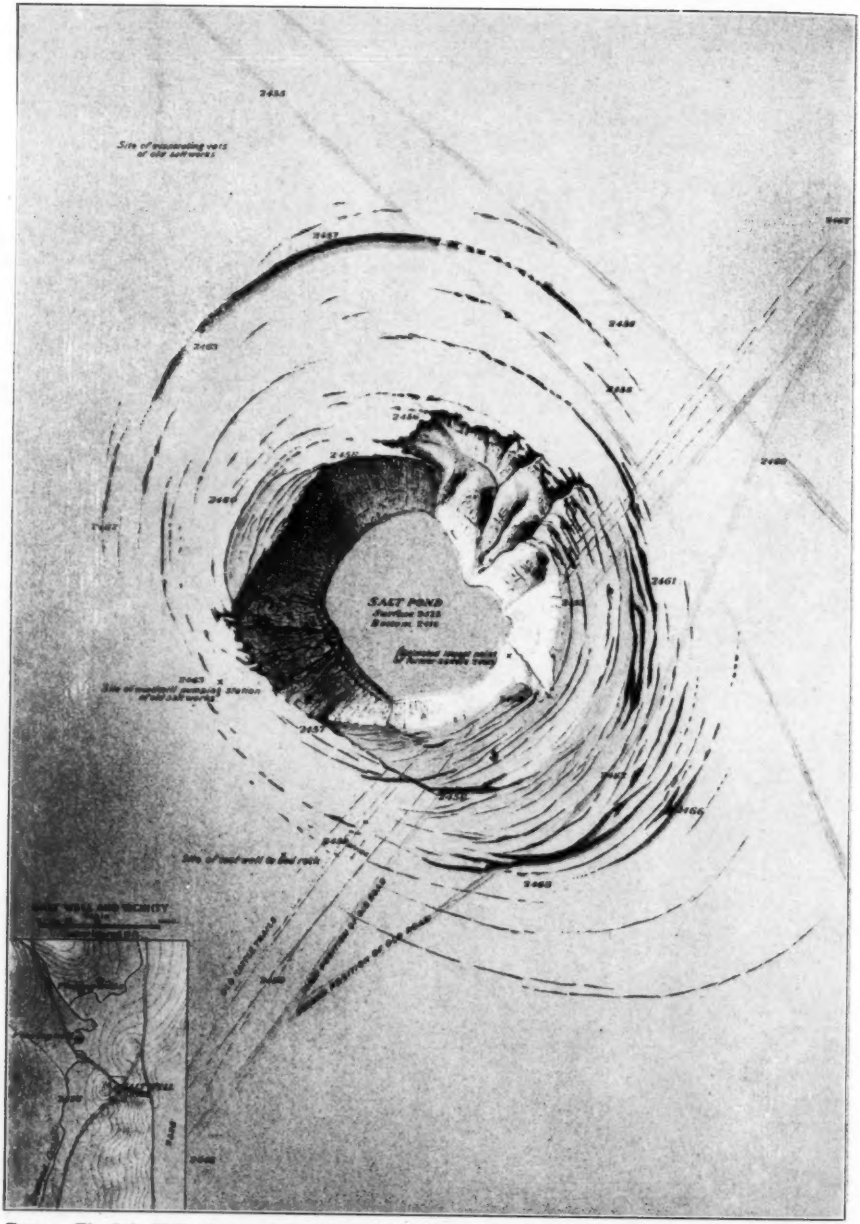

FIG. 1. *The Salt Well. Surveyed by W. D. Johnson for the United States Geological Survey, drawn by H. C. Hunter, and appearing in the Twenty-first Annual Report, No. 4, plate CXXXVI, of the United States Geological Survey. The figures denote the elevations above sea level.* (*See article, "A Curious Salt Pond in Kansas," page 155.*)